U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 972

Air Pollution Abstracts Volume 6, Number 7, July 1975. 48618-49443

Environmental Protection Agency, Research Triangle Park, N C

Jul 75

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. APABCA- 6-7-1975	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Air Pollution Abstracts Volume 6 , No. 7		5. REPORT DATE July 1975
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Pollution Technical Information Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 48618 - 49443.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES 177
	20. SECURITY CLASS *(This page)*	22. PRICE $7.50

EPA Form 2220-1 (9-73)

344035

PB 260 972

Volume 6, No. 7
July 1975
APABCA-6(7)(1975)
US ISSN 0027-5956

AIR POLLUTION ABSTRACTS

48618-49443

July 1975

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, N. C. 27711

AIR POLLUTION ABSTRACTS

VOLUME 6, NO. 7 JULY 1975

Prepared by
Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

Subscribers receiving 'Air Pollution Abstracts'
directly from the U. S. Government Printing Office
should address any inquiries regarding issues
subsequent to June 1972 to:

U. S. Government Printing Office, Washington, D., C. 20402

The Administrator of the Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 31, 1976.

CONTENTS

Introduction ....
APTIC Publications ....
Recent Contract Awards ....
Subject Fields and Scope Notes ....
Abstract Bulletin ....
Subject Index SI-1
The terms that most closely describe the information presented in the documents are arranged alphabetically.
Author Index AI-1
Personal authors are arranged alphabetically. The names are presented last name first. When the author is a primary author, an asterisk precedes the Abstract Number.

INTRODUCTION

This periodical is intended to inform personnel of the Environmental Protection Agency (EPA), and others who are also professionally interested in air pollution, of selected technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Semiannual cumulative indexes to both subject and author are also sent to all recipients of this monthly publication.

EPA's staff should direct requests for full text duplicates (if not locally available) to APTIC, using the order form provided. Translations of foreign language documents may be arranged for these personnel upon request. Commercially available translations may also be requested from APTIC.

For non-EPA readers, APTIC can provide copies of only those articles that have been written by EPA's air pollution personnel and have not been published in the open literature. Requests for all other articles should be directed to local libraries, publishers, or authors, with the following exception. Copies of EPA's numbered air pollution technical publications, as indicated in the citation, will be provided, while supplies permit, only to certain qualified requesters, e.g., its current contractors, grantees, and air pollution control agencies; a list of these publications is available. When requesting any publications, please include the complete citation. Translations are cited with their sources whenever possible. If a translation proves to be unavailable from the source cited, or if a translation is cited without a source, it may be located through APTIC or through the National Translations Center, 35 West 33rd Street, Chicago, Illinois 60616. In order to promote scientific and technical progress by facilitating access to each of the abstracted documents, APTIC is assuring that they are also held at EPA Headquarters and at each of the EPA Regional Offices. Information regarding their accessibility may be sought from the libraries there. Their addresses are:

U.S. Environmental Protection Agency
Region I Library
Room 2211-B, JFK Federal Building
Boston, Massachusetts 02203

U.S. Environmental Protection Agency
Region III Library
Curtis Bldg., 6th and Walnut Streets
Philadelphia, Pennsylvania 19106

U.S. Environmental Protection Agency
Region V Library
230 Dearborn Drive Room 1455A
Chicago, Illinois 60604

U.S. Environmental Protection Agency
Region II Library
26 Federal Plaza
Room 908
New York, New York 10007

U.S. Environmental Protection Agency
Region IV Library
1421 Peachtree Street, N.E.
Atlanta, Georgia 30309

U.S. Environmental Protection Agency
Region VI Library
1600 Patterson Street
Dallas, Texas 75201

U.S. Environmental Protection Agency
Region VII Library
1735 Baltimore Avenue, Room 249
Kansas City, Missouri 64108

U.S. Environmental Protection Agency
Region VIII Library
1860 Lincoln Street, Suite 900
Denver, Colorado 80203

U.S. Environmental Protection Agency
Region IX Library
100 California Street
San Francisco, California 94111

U.S. Environmental Protection Agency
Region X Library
1200 Sixth Avenue
Seattle, Washington 98101

U.S. Environmental Protection Agency
Headquarters Library, Room 2404
Waterside Mall
401 M Street, S.W.
Washington, D. C. 20460

When NTIS or DDC or GPO appear at the end of the citation, they designate the sales outlet offering the document. NTIS refers to: National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161, Telephone (703) 321-8543. The designation NTIS is followed by their order number. NTIS sells paper copies at various prices and microfiche at $2.25. All foreign buyers must add the following charges to each order: $2.50 for each document, and $1.50 for each microfiche. If payment does not accompany a U.S. order, NTIS will charge an additional $5.00 per order. DDC refers to: Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. Users registered at DDC may order such documents from them at the same prices as NTIS'. GPO refers to: Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Telephone (202) 541-3311. GPO sells paper copies at various prices; GPO does not sell microfiche. Payment must accompany all orders to GPO.

The serial publications (journals, periodicals, etc.) being scanned number approximately 7,000. A list of approximately 1,000 of the most productive publications with the address of each publisher is available upon request.

As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of the lapse of time entailed by editorial, make-up, and printing work. More than 1400 subject index terms are available for such searching ---more than those included in the subject index in each issue.

Acknowledgement is given to the Technical Publications Branch, Informational Services Division, Office of Administration, Research Triangle Park, N.C. for the make-up of the cover and for arrangement of printing and distribution.

Feedback from our users, including suggestions of articles, are always welcome.

APTIC Publications

Air Pollution Aspects of Emission Sources: Primary Lead Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:126, $0.65.

Air pollution Aspects of Emission Sources: Primary Copper Production - A Bibliography with Abstracts, June 1973 GPO No. EP 4.9:125, $0.70.

Air Pollution Aspects of Emission Sources: Pulp and Paper Industry - A Bibliography with Abstracts, March 1973, GPO No. EP 4.9:121, $2.35.

Air Pollution Aspects of Emission Sources: Primary Aluminum Production - A Bibliography with Abstracts, June 1973, GPO No. EP 4.9:119, $0.90.

Mercury and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:114, $1.25.

Odors and Air Pollution: A Bibliography with Abstracts, October 1972, GPO No. EP 4.9:113, $3.00.

Air Pollution Aspects of Emission Sources: Petroleum Refineries - A Bibliography With Abstracts, July 1972, GPO No. EP 4.9:110, $1.25.

Air Pollution Aspects of Emission Sources: Iron and Steel Mills - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:107, $1.00.

Air Pollution Aspects of Emission Sources: Boilers - A Bibliography With Abstracts, May 1972, GPO No. EP 4.9:105, $2.00.

Hydrochloric Acid and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:100, $0.55.

Chlorine and Air Pollution: An Annotated Bibliography, July 1971, GPO No. EP 4.9:99, $0.55.

Air Pollution Aspects of Emission Sources: Electric Power Production - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:96, $2.25.

Air Pollution Aspects of Emission Sources: Cement Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:95, $0.50.

Air Pollution Aspects of Emission Sources: Sulfuric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:94, $0.65.

Air Pollution Aspects of Emission Sources: Nitric Acid Manufacturing - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:93, $0.45.

Air Pollution Aspects of Emission Sources: Municipal Incineration - A Bibliography With Abstracts, May 1971, GPO No. EP 4.9:92, $1.00.

Photochemical Oxidants and Air Pollution: An Annotated Bibliography (2 Volumes), March 1971, GPO No. EP 4.9:88, $6.25.

Beryllium and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:83, $0.40.

Asbestos and Air Pollution: An Annotated Bibliography, February 1971, GPO No. EP 4.9:82, $0.50.

Municipal Incineration: A Review of Literature, June 1971, GPO No. EP 4.9:79, $1.00.

Hydrocarbons and Air Pollution: An Annotated Bibliography (2 Volumes), October 1970, GPO No. HE 20.1309:75, $5.00.

The acronym GPO which appears in the above listing refers to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders should be directed to GPO only; payment must accompany all orders.

RECENT CONTRACT AWARDS

from the

Durham Contract Operations
Contracts Management Division, EPA

Contract No. 68-02-2211, RFP No. Du-75-B201	*$86,625.60*

TT-100-36 FOURIER TRANSFORM ACCESSORY FOR VARIAN XL-100 NUCLEAR MAGNETIC RESONANCE SPECTROMETER.

Nicolet Instrument Corporation, 5225 Verona Road, Madison, Wisconsin 53711

Contract No. 68-02-2212, RFP No. Du-75-B170	*$108,000*

DESIGN, DELIVERY AND INSTALLATION OF AN IMAGE ANALYZING SYSTEM FOR THE MEASUREMENT OF GEOMETRIC AND DENSITOMETRIC FEATURE OF POLLUTANTS.

IMANCO, Inc., 40 Robert Pitt Drive, Rockland, New York 10952

Contract No. 68-02-2213, RFP No. Du-75-B119	*$112,780*

STUDIES ON THE EFFECT OF ENVIRONMENTAL VARIABLES ON THE COLLECTION OF ATMOSPHERIC NITRATE AND THE DEVELOPMENT OF A SAMPLING AND ANALYTICAL NITRATE METHOD.

Battelle Memorial Institute, Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201

Contract No. 68-02-1387, Task Order No. 4	*$50,000*

SO2 MODEL FOR ASARCO/TACOMA.

H. E. Cramer Company, Inc., Post Office Box 9249, Salt Lake City, Utah 84109

Contract No. 68-02-1886, RFP No. Du-75-A187	*$185,640*

FUEL DECOMPOSITION AND FLAME REACTIONS IN CONVERSION OF FUEL NITROGEN TO NOx.

Rockwell International Corporation, Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, California 91304

Contract No. 68-02-2205, RFP No. Du-75-B122	*$153,337*

EFFECT OF SHORT TERM EXPOSURES TO INDICATED EMERGENCY LEVELS OF OZONE ON HUMAN MORBIDITY.

Geomet, Incorporated, 15 Firstfield Road, Gaithersburg, Maryland 20760

Contract No. 68-02-2216, RFP No. Du-75-B138	*$200,000*

DEVELOPMENT AND VALIDATION OF A SECOND GENERATION PHOTOCHEMICAL AIR QUALITY SIMULATION MODEL.

Systems Applications, Inc., 950 Northgate Drive, San Rafael, California 94903

Contract No. 68-02-2214, RFP No. Du-75-B075	*$89,981*

DETERMINE FIELD PERFORMANCE CHARACTERISTICS OF GASEOUS MONITORING SYSTEMS AS APPLIED TO HNO3 PLANT EMISSIONS.

Scott Environmental Technology, 2600 Cajon Boulevard, San Bernardino, California 92411

Contract No. 68-02-1797, RFP No. Du-75-B099 .... *$186,030*

DEVELOP PROTOCOL TO CHARACTERIZE GASEOUS AND PARTICULATE EMISSIONS-FUEL ADDITIVE EFFECTS CATALYST- EQUIPPED CARS.

Southwest Research Institute, 8500 Culebra Road, San Antonio, Texas 78284

Contract No. 68-02-2220, RFP No. Du-75-B162 .... *$34,350*

CONSTRUCTION OF A PROTOTYPE SULFURIC ACID MIST MONITOR.

Rockwell International Corporation, Air Monitoring Center, 2421A Hillcrest Drive, Newbury Park, California 91320

SUBJECT FIELDS AND SCOPE NOTES

1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

7. EFFECTS--HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

8. EFFECTS--PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

9. EFFECTS--MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes public opinion studies, public relations, and public information.

14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

ABSTRACT BULLETIN

EMISSION SOURCES

1975

48618 **APTIC NO. 70863**

Biaglow, James A. and Arthur M. Trout

PERFORMANCE AND POLLUTION MEASUREMENTS OF TWO-ROW SWIRL-CAN COMBUSTOR HAVING 72 MODULES. *National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center. Rept. E-8068, Work Unit 501-24, NASA-TM-X-3170 28p., Jan 1975. 9 refs.*

The performance and gaseous-pollutant levels of an experimental full-annulus 72-swirl can combustor were evaluated. Data were compared with those for a previously tested 120 module swirl can combustor. No significant difference in performance or levels of gaseous pollutants was detected. The emission index for oxides of nitrogen was 12.2 g/kg of fuel at simulated takeoff and 8.17 g/kg of fuel at simulated cruise. Unburned hydrocarbon and carbon monoxide levels were compatible with the combustion efficiencies, which were nominally 100%. Exhaust emissions for nitric oxide, total oxides of nitrogen (NO plus nitrogen dioxide), unburned hydrocarbons, CO, and carbon dioxide are tabulated in terms of an emission index. The measured values of the emission index for total NOx varied from 4.84 g of No2/kg of fuel to 14.2 g of NO2/kg of fuel. The emission index for unburned hydrocarbons varied from 12.5 g/kg of fuel to 0.08 g/kg of fuel. The highest emission index value for CO was 88.8 g/kg of fuel, and the lowest was 1.2 g/kg of fuel.

48619 **APTIC NO. 71125**

Block, Chantal and Richard Dams

INORGANIC COMPOSITION OF BELGIAN COALS AND COAL ASHES. *Environ. Sci. Technol., 9(2):146-150, Feb. 1975. 13 refs.*

The elemental composition of 48 coal samples and 20 fly ash samples originating from 12 Belgian coal mines was analyzed by thermal and neutron activation analysis and gamma-spectrometry. A total of 44 elements were identified and classified as either oxyphilic or sulfophilic elements. The first group was present in concentration ratios close to crustal rock, while the second group showed a strong enrichment in fly ash as compared to crustal rock concentrations. Larger concentrations of the sulfophilic elements were observed in low-ash coals. Volatile sulfophilic elements posing possible air pollution problems included: arsenic, antimony, selenium, mercury, cerium, bromine, chlorine, and iodine. Comparisons of the concentrations of these volatile elements in coal and fly ash indicated that selenium, mercury, bromine, chlorine, and iodine are lost during volatilization (combustion). Most of the other elements are probably emitted as fly ash in concentration ratios similar to those in the original coals.

48620 **APTIC NO. 70520**

Dittrich, Walter

PRACTICAL EXPERIENCE WITH MEASUREMENT OF DIESEL ENGINE SMOKE PURSUANT TO ECE-R 24. *(Praktische Erfahrungen bei der Messung von Dieselmotorenrauch nach ECE-R 24). Text in German. Automobiltech. Z. (Stuttgart), 77(1):4-9, 1975. 4 refs.*

Since the ECE regulation 24 demands that diesel smoke of automobiles be measured with opacimeters or units yielding equivalent results, the smoke density of diesel engines was measured with opacimeters and filter units for comparison. Conversion tables, comparative curves, and calculations are provided permitting the conversion of grey tones into opacity units with an accuracy sufficient for practical use. The correlation of measurements obtained with the filters and opacimeters was studied during operation at constant full load and at free acceleration. A relationship could be found in most cases; however, it provided no basis for setting up correlations. Finally, smoke characteristics of induction diesel engines were compared with supercharged engines at different geographical altitudes, based upon practical road tests in the Grossglockner mountains. A linear smoke increase with increasing altitude or decreasing air density was observed.

48621 **APTIC NO. 70378**

Hochdahl, O.

FIRST OPERATING RESULTS OF A 3300 TONS/DAY PRODUCTION LINE WITH LEPOL KILN AT THE LAEGERDORF PLANT. *(Erste etriebsergebnisse einer 3300-t/d-Produktionslinie mit Lepolofen im Werk Laegerdorf). Text in German. Zement-Kalk-Gips (Wiesbaden), 28(1):18-28, Jan. 1975. 1 ref.*

Experience gained in the operation of a 3300 tons/day plant with the world's largest Lepol kiln at the Laegerdorf cement works over a period of 1 yr is reported. The soft raw materials, with a substantial natural moisture content, are efficiently excavated with chain bucket excavators and economically prepared by the wet process. The narrow range of variation in the chemical composition of the raw materials offers ideal conditions for good cement quality. The high water content of the raw slurry is reduced to half by filtration in chamber filter presses, so that the material can be further processed in a grate preheater kiln with heat consumption of 900 kcal/kg of clinker. The first Lepol kiln has been in service for 14 mo, during which period it has performed satisfactorily.

48622 **APTIC NO. 71120**

Maelzig, G. and K. Lusche

CEMENT WORKS AT GEISINGEN - DESIGN, CONSTRUCTION AND EARLY OPERATING EXPERIENCE. *(Zementwerk Geisingen - Planung, Errichtung und erste Betriebserfahrungen). Text in German. Zement-Kalk-Gips (Wiesbaden), 28(1):29-35, 1975.*

The new cement works at Geisingen was put into service 3 1/2 yr ago; its design and construction, together with experience gained in operating the plant, are reported here. The raw materials deposits and the process engineering procedure are described with reference to a manufacturing outline diagram. The problems of environmental protection and the measures adopted for solving them are more particularly considered. The use of an electrostatic dust precipitator with steel equipment in a Lepol kiln plant is described, as is also the construction of the production buildings designed to obviate objectionable noise emission. Altogether three electrostatic precipitators and 21 bag filters have been installed. A novelty is the re-use and dust cleaning of waste air from the cooler. It is drawn off at two points passed through multiclones for removal of coarse dust: one branch then goes to the heat exchanger for warming up oil and the other branch is added to

Preceding page blank

the furnace off-gas. Behind the heat exchanger, the furnace waste gas and the cooler waste air are cleaned in an electrostatic precipitator.

1974

48623 **APTIC NO. 71315**

Ando, J., J. Fuse, A. Matsuura, and S. Nakao

INVESTIGATION OF DUST EMITTED FROM INDUSTRIAL FURNACES (2) PROPERTY OF DUST FROM VARIOUS FURNACES. *(Kogyo-yo nensho shisetsu kara haishutsu sareru baijin chosa (2) nensho shisetsu betsu baijin no tokucho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):423, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 274.)*

Particulates from 13 furnaces, including 3 boilers, were studied for their appearances and characteristics. Particulates in flue gases were collected by cylindrical filter paper method or were collected by deposit cages. Analysis of the particulates was carried out by X-ray diffraction and atomic absorption spectrophotometry. Particulates from boilers contained unburned carbon as the major component whereas those from sintering furnaces and converters contained iron oxides as the major component. The water soluble and insoluble components in dusts collected in the surroundings of the furnaces varied with type of furnace.

48624 **APTIC NO. 71466**

Antonyuk, O. K.

HYGIENIC ASSESSMENT OF GLYCOLS PRESENT IN POLYMER TYPE BUILDING MATERIALS. *(Gigiyenicheskaya otsenka glikoley, vkhodyashchikh v sostav stroitel nykh polimernykh materialov). Text in Russian. Gigiena i Sanit., no. 9:106-107, 1974. 3 refs.*

The volatilization and toxicity of glycols present in fiberglass materials made of MGF-9, TMF-11, PN-3, PN-1-M, and PN-1SP type resins were studied. Fiberglass materials released 0.25-0.11 mg/cu m phthalic anhydride, 0.17-0.031 mg/cu m formaldehyde, 0.21-0.05 mg/cu m styrene, 0.59-0.26 mg/cu m epichlorohydrine, 0.7-0.06 mg/cu m cyclohexanone, and 1.1-0.9 mg/cu m ethylene- and triethylene glycol at 40 and 20 C, respectively. The oral LD50 of ethylene glycol was 9.75 + or - 0.36 ml/kg in albino rats. The highest nontoxic concentration of ethylene glycol and triethylene glycol in the air was 0.3 mg/cu m which is recommended as a maximum allowable concentration. The resins investigated should not be used as construction materials for exposed interior surfaces.

48625 **APTIC NO. 71290**

Bern, Joseph

PROBABLE ENVIRONMENTAL IMPACT FROM THE DISPOSAL OF SULFUR REMOVAL SLUDGES GENERATED BY THE SLAKED LIME-WET SCRUBBER PROCESS. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 198-206. (Oct. 22-24.)*

Leachate tests were conducted on 25 sludge samples generated by slaked lime wet scrubbing of sulfur dioxide-laden flue gases to determine the possible discharge of toxic heavy metals, arsenic, and dissolved solids from ground to surface waters. The sludge samples included intreated sludges, treated (hardened) sludges, and processed sludges (road aggregates). Heavy metal ions do not appear to be an environmental problem from treated or untreated sludges; 98% of the measurements for heavy metal ions were below detection limits or effluent standards. Water quality parameters which consistently exceeded allowable limits were total dissolved solids and sulfates. Potentials leachate analyses from untreated sludges were not significantly different from results obtained from treated wastes. Additional tests using sample preparation methods which generate leachate under reducing (chemical) conditions are suggested. (Author summary modified)

48626 **APTIC NO. 71262**

Bethea, Robert M.

INTERRELATIONSHIPS BETWEEN AGRICULTURE AND AIR POLLUTION. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol. Agric. Air Pollut., Memphis, Tenn., 1974, p. 1-15. 31 refs. (March 18-19.)*

An overview of the interrelationships between agriculture and air pollution is presented. Agricultural sources of particulate and gaseous air pollutants include: rendering operations (odors), confined feeding areas (odorous animal wastes), cotton ginning (particulates), and feed production (particulates). The odor- causing pollutants consist of such compounds as sulfides, mercaptans, ammonia, ketones, and organic acids. Potential control routes for agricultural emissions include: scrubbing processes, incineration, particulate collection with devices such as cyclones or fabric filters, and proper maintenance of agricultural operations. Air pollutants affecting agricultural operations (plants, animals, and agricultural workers) include: sulfur oxides, sulfates, sulfuric acid (acid rains), nitrogen oxides, fluorides, various trace metal compounds, halogens, hydrocarbons, sulfides, mercaptans, cyanides, ozone, ammonia, and halogenated hydrocarbons (e.g., pesticides).

48627 **APTIC NO. 71487**

Davies, C. N.

PARTICLES IN THE ATMOSPHERE - NATURAL AND MAN-MADE. *Atmos. Environ., 8(11):1069-1079, Nov. 1974. 29 refs.*

The existence of natural and man-made particles in the atmosphere is reviewed, with particular emphasis on Aitken nuclei, particles less than 0.1 micron in radius which serve as condensation nuclei for droplet growth. Studies of Aitken nuclei generation in the atmosphere show that only about 15% of these atmospheric particulates are from man-made sources (domestic fuel combustion, industrial effluents, motor vehicle exhaust). Aitken nuclei are produced both directly and indirectly through photochemical gas to particle conversion, with concentrations diminishing at night and during windy weather. Small nuclei formed during the daytime by photochemical action are lost by coagulation with larger particles. Aitken nuclei of natural origin (e.g., volcanoes, forests, and agricultural areas) appear to extend to much greater altitudes than the man-made coarse particles, so that the optical effects of the latter are predominantly within a km above ground level. This implies that the removal of the coarser, man-made particles by natural processes is more efficient than it is for fine Aitken nuclei.

48628 **APTIC NO. 71260**

Fraize, W. E., P. Dyson, and S. W. Gouse, Jr.

ENERGY AND ENVIRONMENTAL ASPECTS OF U. S. TRANSPORTATION. *Mitre Corp., Washington, D. C., Washington Operations, Rept. MTP-391, 83p., Feb. 1974. 45 refs. (Presented at the Intersociety Conference on Transportation, 2nd, Denver, Colo., Sept. 1973.)*

The emission characteristics of U. S. transportation are described according to modes. Highway vehicles (automobiles, trucks, buses) produce nearly all the atmospheric pollutants chargeable to transportation: 95% of unburned hydrocarbons, 96% of carbon monoxide, and 89% of nitrogen oxides. Automobiles contribute 60-75% of all transportation caused emissions. Freight trucking contributes 16% of CO and 23% of NOx. The gasoline fueled truck is considerably more polluting on an aggregate basis than the diesel truck except for NOx emissions. Emissions per seat mile at cruise speed are graphically illustrated for several passenger modes. The AMTRAK Turbotrain is the cleanest of the systems. The diesel bus exhibits a relatively high level of CO and NOx. The intermediate size aircraft produce significant CO, NOx, and particulate emissions even with the smokeless combustors.

48629 **APTIC NO. 71316**

Goto, H. and T. Kato

INVESTIGATION OF VANADIUM IN EXHAUST GASES FROM STATIONARY SOURCE. *(Kotei hasseigen ni okeru banajiumu no haishutsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):424, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 275.)*

Vanadium in flue gases from boilers using heavy oil and coal as fuels was collected by cylindrical filter paper (Toyo 88R filter paper) according to the JIS-Z-8808 method. The filter papers were treated with acid, and benzoylphenyl hydroxylamine (BPHA) was added. The V.BPHA complex was extracted with ethyl alcohol-chloroform and was determined spectrophotometrically. Flue gas particulates from heavy oil containing 55-66 micrograms/g of V had 0.2-3.0% V, depending on burning conditions. Flue gas particulates from coal containing 46-57 micrograms/g of V had 0.007-0.03% V.

48630 **APTIC NO. 70850**

Grinberg, L. and L. Morgan

EFFECT OF TEMPERATURE ON EXHAUST EMISSIONS. *Preprint, Society of Automotive Engineers, New York, 11p., 1974. 9 refs. (Presented at the Society of Automotive Engineers Combined Commercial Vehicle Fuels and Lubricants Meetings, Chicago, Ill., June 17-21, 1974, Paper 740527.)*

Coal-start emission levels of two late-model cars (1972 and 1973 models, V-8 engines, and equipped with exhaust gas recirculation) were tested at temperature of 70, 40, and minus 10 F with two test fuels of different midrange volatility characteristics to assess the effects of ambient temperature on exhaust emissions. Considerable increases in hydrocarbon and carbon monoxide emissions were observed for both test cars as the temperature was decreased, while nitrogen oxides were virtually unchanged. Hydrocarbons increased from 2.0 g/mi at 70 F to 22 g/mi at minus 10 F for one of the cars and from 1.0 g/mi (70 F) to 5.7 g/mi (minus 10 F) for the other car. Carbon monoxide emissions over the same temperature range increased from 52-152 g/mi in one case and from 9.2-59 g/mi in the other case. Most of the increase in emissions, as well as an associated deterioration in fuel economy, occurred during the initial 5-minute period after a cold start. The ambient temperature had no major effect on the pollutant levels emitted during fully warmed-up operation. Emissions were not greatly affected by the midrange volatility of the fuel.

48631 **APTIC NO. 70988**

Guelph, Gee Tsang

FLUE STACK OUTLET. *(Research Corp., New York) U. S. Pat. 3,817,162. 4p., June 18, 1974. 3 refs. (Appl. March 27, 1973, 5 claims).*

A flue stack outlet for increasing the effective height of a smoke stack to decrease ground level pollution by minimizing the entrainment of cold ambient air into the issuing plume is described. Several concentric cylindrical sleeves are mounted at the stack outlet. The inlet ends of the concentric channels formed by the sleeves are in direct communication with the stack outlet, and the outlet ends of the channels are in direct communication with the ambient air. Each channel varies in cross-sectional area between its inlet and outlet ends such that the uniform velocity distribution of the gases in the stack are modified into a cone-shaped velocity distribution. The gas velocities decrease radially in an outward direction from the center of the cone which is the point of maximum velocity.

48632 **APTIC NO. 70344**

Habashi, F., R. Dugdale, and M. Nagamori

PRODUCTION OF COPPER, IRON AND SULFUR FROM CHALCOPYRITE CONCENTRATE Y REDUCTION. *(Die Gewinnung von Kupfer, Eisen und Schwefel aus Kupferkies-Konzentrat durch Reduktion). Text in German. (Metallwirtsch. Metallmarkt), 28(11):1051-1054, 1974. 5 refs.*

Present treatment of copper sulfide concentrations is based exclusviely on oxidation, liberating sulfur dioxide which either leads to atmospheric pollution or to economical problems if a sulfur recovery is attempted. Another method is the reduction of the sulfide, e. g., with hydrogen, to metallic copper. The reduction of chalcopyrite with hydrogen at 800 C is greatly improved by calcium oxide. The reaction products are separated by leaching with diluted hydrochloric acid through which calcium sulfide and iron can be successfully removed from Cu2S concentrate or from metallic copper. The hydrogen sulfide developing at the leaching process can be oxidized to elemental sulfur according to familiar methods. The hydrogen forming at the oxidation process can be returned to the reduction process; ferrous chloride is recrystallized from the solution and reduced to metallic iron. The HCl forming here can be returned to the leaching process.

48633 **APTIC NO. 70561**

Hanashima, Masataka

PROLEMS OF GAS FORMATION AT LAND-FILLED AREAS. *(Umetatechi ni okeru gasu hassei mondai). Text in Japanese. Doboku Gakkai-shi (J. Japan Soc. Civil Engrs.), 59(8):47, Aug. 1974.*

Unlike all other types of problems caused by landfills, such as ground water pollution and proliferation of rats, the formation of gas in landfill areas, and subsequent fire or health hazards and tree damage, do not begin to appear until much later. In Nov. 1973, in a school yard of an elementary school of a city in Japan, methane gas began to be emitted and caused health damages to schoolchildren. The city had an advanced landfill study, but perhaps it rushed too much during the land reclamation program. The area was filled between Nov. 1967 and Dec. 1971 with ordinary urban refuse. The total depth of 22 to 35 m was filled with a multi-layer of 4-5 m of refuse, each layer covered by earth. Immediately after the completion of landfill operation, the school was constructed. Generally, oxygen penetrates to a depth of 3 m, but further than that, anaerobic decompositon without oxygen occurs. This takes place very slowly; initially acidic fermentation, then alkaline fermentation begin. The low class aliphatic acid, a product of an early stage of landfill, degrades into carbonic acid and methane, and suddenly gas begins to increase its formation in the 6-12 mo after the landfill. The amount depends on the amount of organic material in the refuse, but 500 to 700 l of gas is produced from 1 kg of degraded organic material; the ratio of methane is about 50-60%. For these landfill programs, an effective degassing device is desired.

48634 **APTIC NO. 70488**

Harwood, C. F. and T. P. Blaszak

CHARACTERIZATION AND CONTROL OF ASBESTOS EMISSIONS FROM OPEN SOURCES (FINAL REPORT). *IIT Research Inst., Chicago, Ill., Environmental Protection Agency Contract 68-02-1348, Program Element 1AB015, Rept. EPA-650/2-74-090, ROAP 21AFA-004, IITRI-C6290-11, 204p., Sept. 1974. 177 refs.*

NTIS: PB- 238925/AS

The control technology applicable to open sources of asbestos emissions was reviewed with emphasis on mining operations and waste dumps. Site visits were made to asbestos mines and preliminary emission data were collected at one mine and two waste dumps. The control of emissions from mining operations at the five active mine sites is virtually non-existent. Waste dumps from asbestos product manufacturing operations are frequently located in high density population areas. Emissions are created both at the time of transfer of waste to the dump and when the surface is eroded by weather action. Present emission control methods are inadequate. Preliminary ambient air samples were collected using membrane filters at two waste dumps and one mine site. At a distance of 10 km from the source, the number of fibers/cu m greater than 1.5 micron was typically about 10, and the number of fibers smaller than 1.5 micron was about 100 000. While it is known that asbestos can produce asbestosis and cancer, the exact dose relationship, the most harmful fiber size, and the mechanism of disease induction are not precisely defined. An annotated bibliography of control methods is included. (Author conclusions modified)

48635 **APTIC NO. 71114**

Hayama, Tsugio

LET US BE PREPARED FOR THE REGULATION FOR EXHAUST GAS FROM DIESEL-OPERATED ENGINES. *(Dizeru enjin no haiki kisei ni sonaeyo). Text in Japanese. Jidosha Seibi (Automob. Maint.), 28(10):34-49, Oct. 1974.*

When the amount of air inhaled by a diesel decreases, it is attributed to either blocking of an air cleaner or a poorly- adjusted bulb clearance. In the former case, high pressure is applied from inside to outside so as to clean the air cleaner element. The inside part of the air cleaner element case is cleaned from time to time and that an air cleaner is exchanged every 25,000 km. Bulb clearance, in normal cases, widens due to a mutual friction between one end of the bulb stem and one end of the lock arm, which causes noise. When bulb clearance becomes too long, it induces delay of inhalation of fuel and decreases the amount of fuel inhaled, and also delays the initiating timing of gas discharge. There are many diesel-operated engines for which the proper bulb clearance is 0.2 to 0.4 mm. Bulb clearance should be adjusted precisely by observing the prescribed value after the engine is heated enough to be operated. When excessive amounts of fuel are consumed it is attributed to a poorly- adjusted full load stopper and also to a decrease in the propellant pressure of the nozzle. An initial propellant pressure is adjusted so that the handle of a nozzle tester can work at a speed of 10 to 20 strokes/min. In order to observe a change in the condition, length, and angle of atomized fuel and also the size of atomized particles, the handle of a tester must be operated swiftly while the pressure indicated by the gauge is neglected.

48636 **APTIC NO. 71273**

Heggestad, H. E.

AIR POLLUTANTS FROM, AND EFFECTS ON, AGRICULTURE. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 170-177. 8 refs. (March 18-19.)*

An overview of the problem of air pollution generation from agriculture and the effects of air pollutants on agricultural activities is presented. The most important air pollutants generated from agricultural operations include: pesticides, dust, smoke from open burning, allergens, odors, and volatilized nitrogen products. Volatilization is a major pathway for the escape of many gaseous pollutants from farm areas. Compared to the effects of air pollutants from transportation, stationary sources, and industry, air pollutants from agricultural processes has relatively little impact on the crops. Over 80% of agricultural losses due to air pollution are caused by photochemical oxidants. Sulfur dioxide is the most important air pollutant affecting vegetation from a point source. Fluoride injury to vegetation is important in localized areas and is responsible for fluorosis in sheep and cattle.

48637 **APTIC NO. 71468**

Himi, Y., S. Miyazaki, Y. Otsuka, F. Muramatsu, and T. Koyama

AIR POLLUTANT EMISSION FACTOR FROM STATIONARY COMBUSTION PLANT (REPORT 3) EMISSION FACTOR OF HEAVY METAL. *(Kotei nensho shisetsu karano taiki osen bushitsu no haishutsu keisu (dai 3-ho) jukinzoku seibun no haishutsu keisu no kangae-kata). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):420, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 271.)*

Metal components in dusts from glass melting furnaces including continuous tank type furnaces and batch type crucible furnaces were analyzed and the approximate emission coefficient of each metal was calculated. Dusts in flue gas were sampled by JIS-Z-8808 method and metals were analyzed by atomic absorption. For a tank furnace, emission coefficients of 12.8, 54, and 33 were obtained for lead, arsenic, and antimony, respectively, and for a crucible furnace, an emission coefficient of 5.4 was obtained for Pb.

48638 **APTIC NO. 71340**

Hishida, K., H. Nihei, K. Ikeda, A., Koizumi, K. Nagata, and K. Tachibana

CONTROL TECHNIQUE OF NITROGEN OXIDES (PART I) - LOW NOX BURNER. *(Chisso sankabutsu no yokusei shuho ni tsuite (sono 1) - tei NOx bana). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):417, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 268.)*

An investigation was carried out of low nitrogen oxides burners for their Nox prevention effects. Eight burners from 6 manufacturers used A heavy oil, kerosene, and urban gas containing 0.01%, to 0.72% S and 0.01% to 0.03% N as fuels. The combustion gases were analyzed for NOx (nitric oxide and nitrogen dioxide), hydrocarbons, sulfur dioxide, carbon monoxide, and dust. The NO concentrations ranged from 26 ppm to 89 ppm, the HC from trace to 90 ppm, and CO ranged from trace to 311 ppm, depending on the combustion conditions. Fuel containing less than 0.03% N was desirable for NOx prevention.

48639 **APTIC NO. 71477**

Hoelsken, H.

HAZARDS DUE TO GASES, VAPORS, AND SMOKES. *(Gefahren durch Gase, Daempfe, Rauche). Text in German. Schweisstechnik (Vienna), 28(11):228-230, 1974.*

Harmful emissions generated during welding operations and appropriate protective measures are described. Arc-welding operations are accompanied by iron oxide, manganese oxide, silica, calcia, and fluoride emissions, depending on the type of the wire used. Smoke generated during arc-welding contains 30-40% iron oxides, 24-26% silica, 7-25% manganese oxides, 15% calcia, and 22% fluorides. In addition, lead and zinc emissions can be generated when welding is performed on surfaces with lead- and zinc-containing finishes. Inhaled iron oxides may cause siderosis and hemosiderosis, while manganese oxides may cause pneumonia and lesions of the nervous system. No free crystalline silica is generated by arc-welding. Shielded arc welding operations generate metal vapors, ozone, nitrous gases, and fluorides. Carbon dioxide used as a protective gas may form carbon monoxide at high temperature. While CO2, either as a protective gas or as a combustion product is harmless, it may be hazardous especially in limited spaces by displacing air. Periodic ventilation is necessary during welding operations, and local exhaust systems are required for welding in limited spaces, such as in tanks, to prevent the accumulation of poisonous gases such as CO, nitrogen oxides, and ozone.

48640 **APTIC NO. 71485**

Hofmann, Werner

ECOLOGY IN THE RUBBER INDUSTRY. *(Oekologie in der Gummi- Industrie). Text in German. Kautsch. Gummi, Kunstst., 27(11):487-492, 1974. 7 refs.*

Environmental and health hazards due to emission generated in the rubber industry are reviewed. Air pollution is mainly due to dust emissions which are individually controlled to permit recovery of valuable substances. Cyclones are usually unsuitable for dust separation because they are ineffective for the below-10 micron dust fraction. Tissue filters permit dust separation up to 1 micron, and a residual dust concentration of 50 mg/cu m. Wet type and electrostatic dust separation are of secondary importance in the rubber industry. Waste gases are released through high stacks or returned to steam boilers for incineration provided they do not contain chlorine, phosphorus, and sulfur compounds in high concentrations. The allegedly carcinogenic phenyl-beta-naphthylamine is increasingly replaced by other, less harmful stabilizers. The powerful carcinogens benzidine and beta-naphthylamine have been replaced by other substances. The use of asbestos and hydrazine require special safety measures in rubber manufacturing, and the extent of ethylthiourea exposure is well within safe limits. No teratogenicity and mutagenicity of rubber chemicals has ever been observed in rubber workers. Females in the reproductive age must not be exposed to rubber chemicals.

48641 APTIC NO. 70308

Hoshika, Y., S. Kadowaki, I. Kojima, K. Koike, and K. Yoshimoto

THE GAS CHROMATOGRAPHIC ANALYSIS OF SULFUR COMPOUNDS IN THE EXHAUST GAS FROM A KRAFT PULP MILL AND ITS APPRAISAL. *(Kurafuto parupu kojo kara haishutsu sareru io kagobutsu no gasu kuromatogurafu bunseki to sono hyoka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):460, Nov. 1974. 2 refs. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 311.)*

Odorous substances in the exhaust from a kraft pulp mill (treatment capacity, 640,000 tons/yr) were collected in a cold trap and analyzed by gas chromatography. Methyl mercaptan was found to be the major component, followed by dimethyl sulfide.

48642 APTIC NO. 71291

Hulett, L. D., J. A. Carter, K. D. Cook, J. F. Emery, D. H. Klein, W. S. Lyon, G. A. Nyssen, W. Fulkerson, and N. E. Bolton

TRACE ELEMENT MEASUREMENTS AT THE COAL-FIRED ALIEN STEAM PLANT - PARTICLE CHARACTERIZATION. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 207-213. 9 refs. (Oct. 22-24.)*

Fly ash specimens collected from a coal-fired steam plant were studied using scanning electron microscopy and photoelectron spectroscopy techniques. Particle compositions varied greatly as a function of size, and interiors of particles were different in composition from the surfaces. The major elemental constituents of the fly ash samples were aluminum, silicon, sulfur, potassium, calcium, titanium, and iron. Concentrations of iron and aluminum were high in the particle interiors and low at the surface. Sulfur occurred as sulfate and was highly concentrated on the particle surface. Surfaces of fly ash particles collected inside steam plants do not contain as many elements as the surfaces of urban aerosols. (Author abstract modified)

48643 APTIC NO. 70868

Ingalls, Melvin N. and Karl J. Springer

MASS EMISSIONS FROM DIESEL TRUCKS OPERATED OVER A ROAD COURSE (FINAL REPORT). *Southwest Research Inst., San Antonio, Tex., Office of Air and Waste Management Contract 68-01-2113, Rept. EPA-460/3-74-017, 368p., Aug. 1974. 14 refs.*

NTIS: PB 224316/AS

Exhaust emission measurements obtained with a constant volume sampler on 10 1970-1973 heavy-duty diesel-powered vehicles (over 6000 lb gross vehicle weight) operated over the San Antonio Road Route (SARR), a 7.24 mi road course involving several different types of driving, were compared with laboratory results obtained from a chassis version of the 13-mode Federal Test Procedure. The road hydrocarbon and carbon monoxide emissions in terms of g/lb of fuel agreed well with the chassis 13-mode results for a given truck, although the road emissions were generally higher than the 13-mode emissions. The 13-mode results, converted to g/lb of fuel, resulted in substantially higher nitrogen oxide values (60%) overall as compared to results obtained on the road course. Average hydrocarbon, CO, and NOx emissions over the SARR were: 3.01, 18.63, and 13.57 g/lb fuel. Average hydrocarbon, carbon monoxide, and nitrogen dioxide emissions over the 13-mode test were 1.29, 5.62, and 9.90 g/brake horsepower/hr. Run-to-run repeatability of emissions data for the road tests on a given truck varied on an average of 46% for hydrocarbons, 38% for CO, and 23% for NOx. Mass emissions were thus acquired from diesel-powered, heavy-duty trucks while operated on the road.

48644 APTIC NO. 70945

Inoue, K., Y. Iida, K. Yoshizumi, and K. Kubota

DIESEL ENGINE EMISSION AT FREE ACCELERATION. *(Jiyu kasoku-ji no dezeru haiki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):480, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 328.)*

The concentrations of nitric oxide, nitrogen dioxide, hydrocarbons, and smoke density in diesel engine exhaust gas were measured at free acceleration. The numbers of diesel engines used for measurement were seven precombustion-chamber engines, three direct-injection engines (four cycle) and two direct-injection engines (two cycle). Three measurements were made each at the idling and at free acceleration stages, and the average of these three values was used for the analysis. The difference in nitrogen oxides emissions due to the engine type was slight at idling, while a definite difference was observed at free acceleration with a higher NOx concentration shown by direct- injection engines (four cycle) than precombustion-chamber engines. The HC concentration of precombustion-chamber engines was generally lower compared to that of direct-injection engines at idling, and a similar tendency was observed at free acceleration. The smoke density of direct-injection engines (four cycle) was comparatively lower than other types of engines; however, the tendency was inconsistent at idling.

48645 APTIC NO. 71364

Ishii, Akio

INVESTIGATION OF AIR POLLUTION IN URBAN AREA DURING HEATING SEASON, PART 3. *(Ofisubiru gai no taiki osen ni kansuru jissoku chosa, sono 3). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):515, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 362.)*

Areal sulfur dioxide levels near large buildings was measured in relation to building heating from December through March in Tokyo. Three buildings were chosen for the study. They all used oil heating; however, one switched to a town gas in March, with a concomitant decrease in the observed areal SO2 level. The daily average at this location was 2 pphm in mid-March; however, it was 16 pphm when the gas heating system was broken and alternate oil heating was used. Trends of monthly SO2 level at three locations were almost identical; highest in December (10 to 8 pphm) and decreasing toward March (5 to 4 pphm). The SO2 level during weekdays in December was nearly twice that of Sundays.

48646 APTIC NO. 71087

Izumi, Yoshihiro, Yasuyuki Nakajima, Tomiji Nakajima, and Takeo Shoda

CARBON MONOXIDE IN CROSSROAD. (II). *(Kosaten ni okeru issanka tanso nodo haaku no tameno ichi kosaku.*

(Dai-2-ho)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):494, Nov. 1974. (Presented at the National Air Pollution Research Conference, Nov. 6-8, 1974, 15th, Chiba, Japan, Paper 340.)

The carbon monoxide concentration at intersections is most effectively indicated by the average values measured at the four corners. For the estimation of average CO concentration at intersections, the data on average CO concentration, average building height (H), average road width including sidewalk (B), number of vehicles passing the intersection (N), and wind velocity (V) measured at 15 intersections were analyzed by the multiple regression method. Six multiple regression equations were evaluated, and single correlation coefficients obtained were 0.45 for N, -0.58 for V, and -0.47 for B/H. The optimum regression equation for average CO concentration was derived, which gave a correlation coefficient of 0.83.

48647 **APTIC NO. 71320**

Kato, T., T. Sakabe, Y. Tanaka, F. Yokota, and H. Fukaya

RESULTS OF DUST CONTENT AND SOX MEASURED IN STACK GAS FOR THE LAST FEW YEARS. *(Baien sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):418, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 269.)*

Results of investigations conducted from 1965 to 1974 on particulates and sulfur oxides concentrations in flue gases emitted from plants in Aichi Prefecture were reported. Particulates and sulfur oxides were analyzed by the JIS-Z-8808 and JIS-K-0103 method, respectively. The furnaces subjected to the investigations were mainly melting furnaces and boilers. The sulfur oxides emission showed a trend of improvement whereas the particulates emission remained a problem. Analyses of the particulates showed that 4 out of 20 examples had lead concentrations of higher than 10 mg/N cu m and 2 out of 16 examples had cadmium concentrations higher than 1.0 mg/N cu m.

48648 **APTIC NO. 71354**

Kawasaki, G., M. Yamazaki, Y. Hosono, I. Miyamoto, J. Hashimoto, Y. Tanaka, and S. Sakamori

ON THE SUSPENDED PARTICULATES AROUND ELECTRIC FURNACES, PART 1. *(Denkiro kojo shuken no fuyu funjin ni tsuite, sono 1). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):534, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 382.)*

The yearly transition of soot and airborne dust around factories with electric furnaces was examined from 1970 to 1973. Eleven factories were studied and air sampling by high-volume air sampler was carried out at seven to nine stations for each factory. The amount of discharged soot decreased considerably from 1970 to 1971; from 33 tons/day to 10 tons/day, reflecting the installation of dust collectors required at all factories. The airborne dust concentration in 1972 also decreased to 150 micrograms/cu m. Both airborne dust and soot near factories are still decreasing.

48649 **APTIC NO. 71355**

Kawasaki, G., M. Yamazaki, Y. Hosono, I. Miyamoto, Y. Tanaka, M. Doi, and N. Moriyama

ON THE SUSPENDED PARTICULATES AROUND ELECTRIC FURNACES, PART 2. *(Denkiro kojo shuhen no fuyu funjin ni tsuite, sono 2). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):535, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 383.)*

The yearly transition of chromium, manganese, iron, nickel, copper, cadmium, and lead in airborne dust around factories with electric furnaces, was examined from 1970 to 1973. Metal analyses were done by atomic absorption spectrometry after the aqua regia resolution of sample dust trapped with a high volume air sampler. All metal concentrations in dust except manganese decreased from 1970 to 1973.

48650 **APTIC NO. 71455**

Keszthelyi, Karoly, Ferenc Tatrai, Endre Vamos, and Istvan Elek

SOOT FORMATION BY EVAPORATIVE OIL BURNERS AS A FUNCTION OF THE FUEL OIL COMPOSITION. *(Parologtatos olajegok kormozasanak fuggese a tuzeloolaj osszeteteletol). Text in Hungarian. Energiagazdalkodas, 15(9):412-416, Sept. 1974. 13 refs.*

The effect of the fuel oil composition and the air-excess coefficient on soot formation in evaporative oil burners commonly used for domestic heating was studied. Soot formation increased with an increase in the carbon-to-hydrogen ratio of the fuel oil, i.e., with an increase of the naphthene and aromatics content in paraffin fuels. Consequently, fuel oils obtained by the hydrogenating cracking process are best for use in evaporative oil burners. The soot formation also increased with the average boiling point. However, with respect to economic and safety considerations, it is impossible to use lighter fractions. Regardless of the fuel composition, too low or too high an excess-air coefficient also resulted in increased soot formation.

48651 **APTIC NO. 70311**

Kitagawa, Y., S. Ueno, T. Soda, C. Furutani, S. Furukawa, and Y. Sadakane

INVESTIGATION OF MALODORS AROUND STOCK FARMS. *(Chikusan kankei no akushu ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):463, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 314.)*

Two types of treatment (incineration and heat-drying) for chicken manure were compared with respect to odor emanation. Chemical analyses were correlated to answers to malodor intensity questionnaires obtained from 117 households in the neighborhood of the two poultry farms. Incineration resulted in emission of various sulfur compounds in high concentration. Higher odor intensities were reported for the polutry farm utilizing incineration. Ammonia was quantitatively present as the major odor component for both farms. Trimethylamine was hardly detectable.

48652 **APTIC NO. 71449**

Maes, M.

INDUSTRIAL OILS. RECOVERY OR ELIMINATION? *(Les huiles industrielles. Recuperation ou elimination)? Text in French. Mach. Mod., 1974:28-29, 31, Dec. 1974.*

The incineration and pyrolytic recovery of industrial waste oils is outlined. Conventional, rotary, and fluidized-bed furnaces are used for the incineration of used oils. Water, carbon dioxide, sulfur dioxide, and (depending on the composition of the oil) nitrogen oxides are the combustion products. To achieve the best possible combustion, the used oil must be dispersed finely before admission into the combustion chamber, and be mixed completely with the auxiliary fuel. The combustion chamber temperature should be between 850 and 1000 C. Fluidized-bed combustion chambers are suitable for the destruction of grease, oil, tar, and sludge.

48653 **APTIC NO. 70309**

Matsumoto, H.

ANALYSIS OF ODOR COMPOSITION IN STARCH LEES. *(Denpun kasu no akushu seibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):461, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 312.)*

Analysis of odor composition of starch lees was conducted. Use of Porapak Q as the packing material in the gas chromatography column allowed separation of low fatty acids as acids, rather than as esters. Representative odorous acids found in starch lees included acetic acid (47 ppm), propionic acid (29 ppm), and n-butyric acid (16 ppm).

48654 **APTIC NO. 71370**

Matsuura, A., J. Ando, J. Fuse, and S. Nakao

INVESTIGATION OF DUST EMITTED FROM INDUSTRIAL FURNACES (1) SIZE DISTRIBUTION AND ITS METAL CONTENTS. *(Kogyo-yo nensho shisetsu kara haishutsu sareru baijin no chosa (1) ryukei bunseki to sono kinzoku seibun). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):422, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 273.)*

Particle distributions of heavy metals in dusts emitted from various industrial furnaces were studied. The measurements were made by constant-velocity suction in the flue by cascade impactor and by Andersen stack sampler. Metals were analyzed by atomic absorption. Small particles predominated and the distributions were close to the logarithmic normal distribution. Analyses by Andersen pipet and microscope were also carried out for comparison. Logarithmic normal distributions were not obtained by the latter methods. Small particles contained a greater variety of metals.

48655 **APTIC NO. 70929**

Natusch, David F. S.

THE CHEMICAL COMPOSITION OF FLY ASH. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 731-775. 34 refs. (Jan. 15-18, Paper 31.)*

The chemical composition of fly ash is discussed in terms of developing control strategies based on relationships between particle size and toxicity of particle composition. Toxic species such as arsenic, antimony, lead, thallium, mercury, cadmium, selenium, vanadium, nickel, chromium, sulfur, and beryllium are contained in fly ash along with a multitude of other naturally occurring elements. In fly ash derived from coal combustion, many of these toxic elements increase in concentration with decreasing particle size. Often these particles are of respirable size and are too small to be efficiently collected. The preferential concentration of toxic element onto small particles is possibly due to volatilization of the element or one of its compounds followed by adsorption or condensation onto the small particles. Substantial fractions of most coal fly ashes are ferromagnetic and even higher proportions of many toxic species are associated with this magnetic fraction; thus, the possibility of employing magnetic collection for preferential collection of toxic particulates is suggested. Another possibility for control is to provide an alternative surface for deposition.

48656 **APTIC NO. 71319**

Ono, Tatsuo and Yoshikazu Hasegawa

EVAPORATION EMISSIONS OF HYDROCARBONS FROM FUEL OIL STORAGE TANK. *(Nenryo yu tanku kara no tanka suiso no johatsu ni yoru haishutsu). Text in Japanese. Denryoku Chuo Kenkyusho Gijutsu Dai-ichi Kenkyusho Hokoku (Tech. Lab. Central Res. Inst. (No. 1) Electric Power Ind., Rept.), no. 74020, 38p., Aug. 1974. 21 refs.*

Evaporation emissions of hydrocarbons from fuel storage tanks are comprehensively surveyed. Material in the article was taken mainly from publications of the American Petroleum Institute (API) and the United States Environmental Protection Agency (EPA). Calculations are based on measurements taken by API in 1962 on more than 200 installations. Hydrocarbon emission factors determined by the United States EPA are also based on the API calculations. Factors influencing evaporation emissions, kinds of evaporation emissions, and determination and calculation of amounts of evaporation emissions are described.

48657 **APTIC NO. 71470**

Oya, F., K. Yoshitani, T. Kanaji, and Y. Himi

AIR POLLUTANT EMISSION FACTOR FROM STATIONARY COMBUSTION PLANT (REPORT 1) EMISSION OF SOOT AND DUST. *(Kotei nensho shisetsu karano taiki osen bushitsu no hai shutsu keisu (dai i-ho) kakushu nensho shisetsu ni okeru baijin no haishutsu jokyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):419, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 270.)*

Measurements of dusts were carried out for large-scale facilities in the Tokyo-Yokohama area, and the emission coefficients were calculated. Dusts were sampled by the JIS-Z-8808 method with cylindrical filter paper. The fuels used in the furnaces ranged from A heavy oil to cokes. The emission coefficients ranged from 2.03 kg/kl-fuel for a zinc melting furnace to 3110 kg/kl-fuel for a cement kiln. The emission coefficients for furnaces with dust collectors ranged from 0.02 kg/ton-product for a cupola furnace to 4.99 kg/kl-fuel for an aggregate drying furnace. Bag filters generally gave the highest dust collection efficiency followed by electrostatic precipitators.

48658 **APTIC NO. 71499**

Pierson, W. R. and Wanda W. Brachaczek

AIRBORNE PARTICULATE DEBRIS FROM RUBBER TIRES. *Rubber Chem. Technol., 47(5):1275-1299, Dec. 1974. 54 refs. (Presented at a joint meeting of the Rubber Division of the Chemical Institute of Canada, Toronto, May 7-10, 1974.)*

Road tests in tunnels and in the open air were conducted to determine the amount of airborne particulate debris generated from rubber tires. Airborne particulates accounted for a small fraction of the total tire wear, with most of material worn from tires being in the form of nonsuspendable particulates deposited near the road. Tire debris comprised about 1-4% of the total airborne particulate matter generated by road vehicles of all categories in tunnels. Depending on driving conditions, the amount of airborne tire particulate matter ranged from 5-45% (20% average) of that emitted from the exhausts of gasoline engines burning leaded fuel. The concentration of airborne tire particulate matter in urban areas appears to be about 1 microgram/cu m or 1% of the total particulate loading. The nationwide production of airborne tire particulates (about 50,000 tons/yr) does not appear to justify the consideration of tire wear as a major source of pollution. (Author conclusions modified)

48659 **APTIC NO. 71268**

Rogers, Hugo, Michael R. Overcash, and Lyman A. Ripperton

CONTROL OF LIVESTOCK WASTE ODORS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 104-116. 36 refs. (March 18-19.)*

The occurrence, identification, and control of livestock waste odors are reviewed. The main sources of such odors are dairy farms, beef feedlots, swine operations, and poultry production. Presently, human panels are the best approach to odor assessment, though analytical methods including gas-liquid and paper chromatography, infrared and nuclear magnetic resonance spectroscopy, mass spectrometry, and flame photometry are being developed. Odor control techniques can be divided into the following three categories: physical processes, chemical addition, and biological treatment. Physical processes include: drying, spreading, storing, and good housekeeping practies. A variety of chemicals such as potassium permanganate, chlorine, and lime may be used for short-term odor control. Biological treatment means include: anaerobic and aerobic lagoons and commercial starter cultures of certain microorganisms. More recent approaches to odor control include: manure recycling, soil filtration, and predictive meteorological models. (Author abstract modified)

48660 **APTIC NO. 70484**

Rogers, J. E. L., A. F. Sarofim, J. B. Howard, G. C. Williams, and D. H. Fine

COMBUSTION CHARACTERISTICS OF SIMULATED AND SHREDDED REFUSE. *Preprint, 32p., 1974. 16 refs. (Presented at the International Symposium on Combustion, 15th, Tokyo, Japan, Aug. 25-31, 1974.)*

An experimental batch incinerator was used to measure burning and ignition rates in simulated and shredded refuse beds; and provisions were made for measurement of refuse weight and fuel- bed temperature distributions during combustion, as well as the concentrations of carbon monoxide, carbon dioxide, hydrogen, oxygen, and methane within the fuel bed. The burning rates of the shredded refuse were insensitive to the fineness of shredding but varied with fuel bed density. Overfire air penetrated the bed at low underfire air rates and augmented the burning rate for loosely-packed shredded refuse; and at high underfire air rates, burning rates became ignition limited, and burning bed depths were approximately constant during the steady burning regime. No difficulty was experienced in initially igniting the shredded refuse even when underfire air rates of 275 lb/hr/sq ft were employed at the start of the run. The fuel bed gas composition measurements suggested that the water gas shift reaction, involving CO plus water to give CO_2 and H_2, was close to equilibrium at the top of the bed, providing a rough guideline for determining overfire air requirements. The simulated refuse was characterized by prolonged periods of drying and pyrolysis after the surface of the fuel element had ignited. (Author abstract modified)

48661 **APTIC NO. 70310**

Saijo, T., K. Saito, E. Ebisawa, and K. Taguchi

MALODORS FROM PIG FARMS. *(Yoton shisetsu no akushu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):462, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Nov. 6-8, 1974, Paper 313.)*

Components and causes of malodors from pig farms were identified. Chemical deodorization of these odors was attempted. Malodors arise mostly from porcine feces and urine. Sprinkling deodorizing solution (organic acids and phenols) on waste matter reduced ammonia odor by 66-80% over a 10-hour period. Similar tendencies were observed with trimethylamine malodor.

48662 **APTIC NO. 70559**

Saito, Junichi and Koichi Sugiyama

FLUIDIZED SLUDGE INCINERATION SYSTEM. *(Odei ryudo shokyaku Shisutemu). Text in Japanese. Sangyo Kikai (Ind. Machinery), no. 287:14-17, Aug. 1974.*

A fluidized sludge incinerator developed by the abcock-Hitach Company is discussed. The fluidized bed diameter was 1000 mm, incineration quantity was 400 kg/hr, and treatment population was 20,000. The system consisted of a fluidized incineration with a sludge supply chute, a cement clinker supply hopper, an air cooler, an air temper, blow fans, multicyclones, an induced fan, tower bag filters, an ash conveyor, and an ash bunker. An ordinary dried sludge cake and dehydrated cake mixed with carbon particles were made and burned in the fluidized incinerator utilizing cement clinkers as a fluidization medium. The results were tested, and various gas formation was examined. y adding micro particles of carbon, the incineration quantity increased by 20-30%, but in a natural incineration, the load can be 40-60% higher, therefore the incinerator can be designed compactly. A considerable amount of sulfur and chlorine were contained in the sludge cake, and by adding carbon particles, sulfur dioxide and hydrogen chloride were formed in the combustion process. The clinkers acted as desulfurization and dechlorination agents. The surfaces of catalysts required constant regeneration, and by constantly rubbing against each other, the chemical activity of cement clinkers was maintained. When the temperature went above 850 C, the desulfurization and dechlorination rate suddenly decreased. ut at about 800 C, the desulfurization and dechlorination rates were above 90 and 80% respectively. When simply filtered and dried, sludge was burned with fuel oil, and 700-1200 ppm of nitrogen oxides were formed. ut when micro-particles of carbon were added, the amount of NOx formation was decreased to 1/5. All the organic matter causing bad odor was degraded at about 750 C; since the incinerator was operated at 800 C, odor elements were decomposed in a few seconds.

48663 **APTIC NO. 71371**

Samata, M.

DUST CORRELATION AND EMISSION FACTOR OF BOILER. *(Boira ni okeru baijin-ryo no tokusei to haishutsu keisu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution). 9(2):421, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 272.)*

Investigations were carried out on 70% of all boilers in Yokohama in 1973. The boilers were divided into 3 groups, namely, small boilers (under 200 l/hr), medium boilers (200-1000 l/hr), and large boilers (above 1000 l/hr). Measurements of dusts were by the JIS-Z-8808 method. Linear relationships exist between fuel consumption and total gas emission and total dust emission. An average particulate concentration of 0.022 to 0.063 g/N cu m for small boilers and 0.02 to 0.163 g/N cu m for medium boilers were obtained, depending on the kind of fuel used. For large boilers, the average values were higher than 0.075 g/N cu m.

48664 **APTIC NO. 70572**

Sawanobori, Tatsuhiko and Masayuki Saito

NITROGEN OXIDE POLLUTION FROM HEATING EQUIPMENT. *(Danboyo kigu ni yoru NOx osen). Text in Japanese. Preprint, Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, p. 55-58, 1974. (Presented at the Society of Heating, Air Conditioning, and Sanitary Engineers of Japan Annual Meeting, Tokyo, Japan, Oct. 7-8, 1973, Paper A-14.)*

The pot-type petroleum stove with forced ventilation is the most popular type of domestic heating equipment in Japan. The combustion characteristics and nitric oxide emission rate were obtained by experiments for the purpose of comparing the amount of NOx emission from ordinary homes and building heating systems. The heating efficiency was obtained by an equation, and the exhaust gas temperature was measured by a CA thermocouple. The air ratio and the combustion gas quantity were calculated by analytical results. The NOx emission unit calculated from the load curve for the entire period stoves are in use would be about 2.0 kg/t of fuel. Of the total of 305 tons of NOx emission for the season in Sapporo, 66% came from general domestic heating, 18% from local heating systems, and 16% from building heating systems. As far as the oil consumption is concerned, 82% is by domestic heating, 5% by local heating systems, and 13% by building heating systems. ut for the coldest season, the NOx emission is 74% from general domestic heating, 12% from buildings, and 14% from local heating systems; in light heating seasons, 59% of NOx emission comes from domestic heating, 20% from local heating systems, and 21% from building heating systems. These domestic stoves are structurally impossible to change into combustion recirculation type; some method of increasing air ratio and controlling combustion heat would be desirable. ut if the stove is used also as a hot water boiler, heat loss will be recovered.

EMISSION SOURCES

48665 **APTIC NO. 71252**

Sawyer, Robert F., Nicholas P. Cernansky, and Antoni K. Oppenheim

FACTORS CONTROLLING POLLUTANT EMISSIONS FROM GAS TURBINE ENGINES (INTERIM REPORT). *California Uni ., Berkeley, Dept. of Mechanical Engineering, Air Force Office of Scientific Research Contract AFOSR-72-2299, Proj. 9750-02, Task 681308, Program Element 61102F, AFOSR-TR-74-0192, 15p., 1974. 31 refs.*

NTIS, DDC: AD 775094

Primary pollutants emitted by aircraft gas turbine engines are carbon monoxide, hydrocarbons, aldehydes, smoke, particulates, and nitric oxide. Factors controlling emissions of these pollutants are analyzed on the basis of aircraft engine exhaust composition and laboratory studies of gas turbine combustion processes. An analytical prediction of the effect of aircraft operating parameters on the emission of NO is also given. Measurements of aircraft engine exhaust compositions from several different turbojet, turbofan, and turboprop engines revealed striking similarities in their pollutant emission characteristics. Carbon monoxide, hydrocarbons, and aldehydes were at their peak values during idle operation and dropped to very low levels as engine power was increased. Particulates, smoke density, and nitric oxide increased with power level, the latter depending exponentially upon the maximum local combustor temperature. The formation and destruction of these pollutants were investigated in a laboratory gas turbine combustor. The oxidation of CO, HC, and aldehydes was measured in the dilution zone where thermal quench pheonomena were observed. The apparent oxidation of particulates in the dilution zone was also observed; details of the particulate studies are reported in a companion paper. The formation of NO was observed in the primary zone and in the first part of the dilution section of the combustor. Operational conditions and engine parameters such as ambient temperature, pressure, humidity, flight altitude, flight Mach number, water injection, fuel properties, and combustor characteristics were studied analytically, yielding rational criteria for the prediction of their effect on the emission of NO. (Author summary)

48666 **APTIC NO. 70312**

Shigeta, Y., T. Ishiguro, T. Hasegawa, Y. Nagata, and N. Takeuchi

FIELD SURVEY OF ODOR AT NIGHT-SOIL TREATMENT PLANTS. *(Shinyo- funnyo no shuki chosa jirei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):464, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 315.)*

Odors emanating from waste treatment plants and kraft pulp mills were surveyed. Concentrations of odorous substances (hydrogen sulfide, methyl mercaptan, dimethyl sulfide, dimethyl disulfide, and ammonia) and physical responses to the odors were determined and correlations were derived. The major malodors from waste treatment plants were attributed to H2S and CH3SH, but (CH3)2S was also present. Malodors from kraft pulp mills included all four sulfides (H2S, CH3SH, (CH3)2S, (CH3)2S2).

48667 **APTIC NO. 71163**

Stolarski, R. S. and R. J. Cicerone

STRATOSPHERIC CHLORINE: A POSSIBLE SINK FOR OZONE. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 247-252, Dec. 11-12, 1974. 26 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

Potential tropospheric sources of stratospheric chlorine are discussed. Chlorine from ground level sources can diffuse upward through the troposphere into the stratosphere. Likely sources are industry, sea salt spray, and fumaroles. Fumaroles emit gaseous Cl2 and hydrochloric acid. Sea salt spray contributes Cl2-containing particles, some of which lead to gaseous Cl2. Industrial processes emit Cl2 in many forms, particularly hydrochloric acid. The gaseous Cl2 content at sea level was measured at about 1 ppb. This concentration will vary with altitude in the troposphere because of loss through rainout of HCl, but indicates that the assumed value is reasonable. Other potential sources are direct injections by volcanic explosions and solid fuel rockets. They are likely to involve large amounts of Cl2 because they are often associated with intrusions of sea water.

48668 **APTIC NO. 70594**

Strauch, D.

HYGIENIC PROLEMS OF LARGE ANIMAL CONFINEMENTS. *(Hygiene probleme der Massentierhaltung). Text in German. Zentralbl. akteriol. Hyg., Infektionskr. Abt. Orig. , 159(4):309-323, 1974. 16 refs.*

Keeping animals in large confined areas causes odors and infection problems. Chemical disinfection or physical treatment of the animal manure helps avoid spreading of infectious microorganisms by using the excrements as fertilizer. Too much animal waste slurry on agricultural fields can cause odor and damage to the soil and plants. Hygienic problems are also created by feeding antibiotics to animals which may cause infectious resistance in various types of bacteria. The influence of untreated effluents on water pollution is also important. Rendering plant effluents can also cause water pollution. Legislation is being passed to reduce environmental nuisances caused by large animal confinements. Problems of odor emissions from large animal confinements are solved in many cases by aerobic aeration methods such as the aeration system by Fuchs or the oxidation ditches installed in pig stys. Other methods applied are dilution of the waste air coming from the confinements, scavenging of the waste air, or addition of chemical or biological deodorants. Ozone treatment, ultraviolet radiation, ionization activated coal, biofilters, and waste air burning are methods which are used by industries for combating odors. For reasons of costs they are mostly not used in large animal confinements.

48669 **APTIC NO. 71361**

Suga, Kunio, Shigeru Aoki, Kiyoshi Kawai, and Shusaku Nishimura

AIR POLLUTION BY ANTIMONY. THE INVESTIGATION OF POLLUTION SOURCE AND ENVIRONMENT. *(Anchimon ni yoru taiki osen ni tsuite, hasseigen to kankyo chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):541, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 389.)*

Antimony pollution associated with an antimony refinery in Shiga Prefecture was studied. Soot and dust before and after the refinery cleaning tower were collected. Airborne particulates were also collected from four locations within the refinery grounds and four more locations outside the grounds. A high-volume air sampler was used to collect sample dust, and antimony was analyzed by atomic absorption spectrometry and colorimetry. The maximum dust amounts on refinery grounds ranged from 37.6 to 75.9 and 87.0 to 617 micrograms/N cu m for February 1974 and October 1973 respectively, and the amounts of antimony found in the dusts were 0.38 to 13.2 and 0.65 to 7.18 micrograms/N cu m for the same periods. The amount of soot and dust was reduced by 50% by the cleaning tower.

48670 **APTIC NO. 70376**

Sunaga, Takeshi

AD ODORS FROM STOCKYARDS AND ANIMAL HUSANDRY. *(Chikusan kogai ni okeru akushu ni tsuite). Text in Japanese. Kachiku Hoken Eisei Gijutsu Kenkyukai Kaiho (ull. Assoc. Tech. Animal Hyg.), no. 22:21-23, 1974.*

A total of 3218 complaints on pollution were filed in Fukuoka in 1972, among them 27.2% resulted from bad odors. About 70% of the complaints on bad odors related to stockyards and animal husbandries. An investigation on odors was conducted at a combustion furnace and a plastic house used for treating animal wastes. The combustion furnace treated excrements from 1000 pigs and cows, and the plastic house dried excrements from 10,000 chickens in summer and 6000 in winter. Methyl mercaptan, hydrogen sulfide, and methyl sulfide were determined by gas chromatography, and ammonia determined by pridine-pyrazolone method. The NH_3, CH_3SH, and H_2S concentrations 20 m from the furnace and those at the plastic house were higher than the environmental standards.

48671 **APTIC NO. 70941**

Suzuki, F.

AN ESTIMATION OF PCTS IN INCINERATORS. *(Seiso kojo ni okeru PCT ryo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):440, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 291.)*

Polychlorinated biphenyls and polychlorinated triphenyls in combustion gases were sampled by an n-hexane absorption, florisil (5% glycerine-coated) column absorption, and filter paper method; concentrations were determined by peak height and the chlorination method. The concentrations of the two substances in dust from a collector was also analyzed by an alkaline method. The PCBs were chlorinated into dichlorinated biphenyls which gave one peak while PCTs gave three peaks corresponding to ortho, meta- and para-dichlorinated triphenyls. Waste gases from a garbage incinerator contained 4.01 to 21.2 micrograms/N cu m of PCB and trace amounts to 9.56 micrograms/N cu m of PCT. Dusts sampled from a multicyclone and an electrostatic precipitator contained 0.14 to 1.10 micrograms/g of PCB and PCT.

48672 **APTIC NO. 70872**

Welch, Richard O., William E. Franklin, and Robert G. Hunt

RESOURCE AND ENVIRONMENTAL PROFILE ANALYSIS OF SOLID WASTE DISPOSAL AND RESOURCE RECOVERY OPTIONS. *Preprint, Midwest Research Inst., Kansas City, Mo., 32p., 1974 (?). 5 refs.*

A comparison of four basic waste disposal and resource recovery options was made to determine which option results in the most favorable resource recovery and environmental profile. The four options studied were: incineration with energy recovery, pyrolysis with energy recovery, conventional incineration, and sanitary landfill. the incineration process with energy recovery showed the most favorable resource and environmental profile, followed by pyrolysis, sanitary landfill, and incineration without energy recovery. The amounts of air pollutants per 1000 tons of waste generated from these processes were respectively: 6.5, 6.9, 0.5, and 6.2 lbs. The pyrolysis system recovered the most materials (both metal and glass), though it also was the most polluting. The landfill option showed the largest municipal solid waste value.

48673 **APTIC NO. 70396**

Federal Energy Administration, Washington, D. C.

PROJECT INDEPENDENCE REPORT. *Preprint, 804p., Nov. 1974. 44 refs.*

GPO

An environmental analysis of energy strategies was performed using the Federal Energy Administration analytical model for particulates, nitrogen oxides, sulfur oxides, hydrocarbons, carbon monoxide, and aldehydes. The strategies were business as usual, accelerated supply, conservation, and conservation/ demand management for $11 oil and business as usual and accelerated supply for $7 oil. Except for the demand management strategy, SOx, CO, and HC emissions were less for all strategies in 1985 than for 1972. Particulates, NOx, and aldehydes were greater for all strategies. Demand management produced the highest level of air pollutants except for hydrocarbons and aldehydes. The lowest adverse environmental effect was from the $11 conservation strategy. Emissions of SOx generally decreased in all geographical regions in 1985 from 1972 levels. Hydrocarbon emissions increased 250% in the South Atlantic region due to natural gas production.

48674 **APTIC NO. 70805**

Boeing Commercial Airplane Co., Seattle, Wash., Preliminary Design Dept.

ADVANCED SUBSONIC LONG-HAUL TRANSPORT TERMINAL AREA COMPATIBILITY STUDY. VOLUME II - RESEARCH AND TECHNOLOGY RECOMMENDATIONS (FINAL REPORT). *National Aeronautics and Space Administration Contract NAS1-12018, Rept. D6-22562, NASA CR- 132368, 162p, Feb. 1974. 3 refs.*

NTIS N74-16730

An advanced subsonic long-haul transport terminal area compatibility study is presented which provides 50 recommended research items involving aircraft emissions, noise, congestion, and other potential problems in therms of state of readiness, potential payoff, and estimated cost and schedule. Premix, fuel/air swirling and dual-staging combustion are some of the concepts scheduled for testing in programs to meet 1979 Environmental Protection Agency emission standards for hydrocarbons, nitrogen oxides, and carbon monoxide. Advanced prevaporization and premix developments are recommended to effect more uniform fuel/air ratios, and catalyst investigations are recommended to determine emission reduction through lower burn temperatures. Advanced variable-geometry systems investigations are recommended for more precise fuel/air ratio control at low power settings. The development of a terminal area air pollution model and a terminal area meteorology model are also recommended. Also proposed is the use of inversion data from six major polluting airports to determine the influence of aircraft emissions on total ground area emissions, with the data being integrated into an air quality model for the airport.

48675 **APTIC NO. 70937**

Navy Environmental Support Office, Port Huenema, Calif., Naval Environmental Protection Support Service

A FIELD GUIDE TO INVENTORYING AND ESTIMATING AIR EMISSIONS. *NESO Rept. 20.2-004, 34p., July 1974. 2 refs.*

A guide is given to provide personnel working in the field a reasonable technique for estimating air pollution emissions from selected processes and equipment. The mass emission inventory is an effective approach to quantify the Navy's air pollution emissions. The technique provides a reasonable estimate of emissions from process, production, or consumption rates through the application of mass emission factors. Data should be collected through on-site surveys which categorize the potential emission sources. Typical Navy emission categories are listed. Mass emission factors are being developed to provide a means of estimating emissions based upon material process or comsumption rates. The application of mass emission factors for estimation of pollution emission rates is based on the following equation: estimated emission rate equals the process rate times the mass emission factor. A compilation of mass emission factors is presented in an appendix.

48676 **APTIC NO. 71192**

Dept. of thy Army, Philadelphia, Pa., Frankford Arsenal

GUN OBSCURATION TRANSMISSION MEASUREMENTS (INTERIM SUMMARY REPORT). *91p., 1974 (?).*

Continuous-wave, pulsed, and modulated laser sources were used to obtain broadband and narrowband spectral transmission measurements during tank gun and Vulcan firings to establish a data base pertinent to the problem of projectile sensing in a gun environment. Meteorological and dust particle size data were also taken. Propellant compositions included: nitrocellulose, nitroglycerin, nitroguanidine, ethyl centralite, barium nitrate, potassium nitrate, potassium sulfate, diphenylamine, dinitrotoluene, dibutylphthalate, graphite, cryolite, tin dioxide, calcium carbonate, and sodium sulfate. Values of transmission versus time after projectile firing are plotted along with meteorological conditions and particle count readings for each firing. Comparison of two or more spectral regions for a given round revealed that for an M490 round the transmission in the visible region at 0.6 micron exceeded that in the mid- and far-infrared regions during minimal dust conditions. During later firings when induced dust was prevelant, a high degree of correlation appeared between the visible and infrared regions. Moderate to heavy dust conditions appeared to cause severe transmission loss. The separate treatment of high and low dust conditions is recommended for future studies to determine the effects of dust versus propellant absorption.

48677 **APTIC NO. 71223**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD METHODS OF TEST FOR TOTAL SULFUR IN THE ANALYSIS SAMPLE OF COAL AND COKE. *Book ASTM Stand., no. 26:674-677, 1974. 7 refs.*

Two standard gravimetric methods for the determination of total sulfur in samples of coal and coke are described. The procedures comprise the Eschka Method and the Bomb Washing Method. Both methods rely on the amount of barium sulfate precipitated after the addition of barium chloride. The analytical results are calculated to a dry basis by using the percentage of moisture found in a sample passing a number 60 (250-micron) sieve. Repeatability is within 0.05% for coal (under 2% sulfur), 0.10% for coal (over 2% sulfur), and 0.03% for coke. Reproducibility is within 0.10% for coal (under 2%), 0.20% for coal (over 2% sulfur), and 0.05% for coke.

48678 **APTIC NO. 71248**

Dept. of the Environment, London (England), Scottish Development Dept. and Welsh Office

THE 110TH ANNUAL REPORT ON ALKALI, ETC. WORKS 1973. *117p., 1974.*

Inspection activities of the Department of the Environment relating to the reduction of industrial air pollution in Wales and Scotland are reported for the year 1973. Major industrial groupings covered in the report include the chemical industries, metal industries, and fuel industries (electrical generating plants, gas and coke works, and petroleum refineries). Data are presented on the number of inspections made, complaints received, and infractions observed during the year. Average test results of gaseous and particulate emissions from all registered works as well as some unregistered works are presented in appendices.

48679 **APTIC NO. 71255**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD METHOD OF TEST FOR FORMS OF SULFUR IN COAL. *Book ASTM Stand., no. 26:507-511, 1974. 5 refs.*

A standard method for the determination of sulfate, pyritic sulfur, and organic sulfur in coal samples is described in terms of apparatus, reagents and materials, procedure, and calculations. Sulfate sulfur is gravimetrically determined by extracting a weighed sample of coal with dilute hydrochloric acid followed by precipitation with barium chloride and weighing as barium sulfate. Pyritic sulfur is volumetrically determined by extracting a weighed sample of coal with dilute nitric acid followed by titrimetric determination of iron in the extract as a measure of pyritic sulfur. Organic sulfur is determined by subtracting the sum of sulfate sulfur and pyritic sulfur from the total sulfur. The repeatability of the method is within 0.02% for sulfate, 0.05% for pyritic sulfur (under 2%), and 0.10% for pyritic sulfur (2% or over). The reproducibility of the method is within 0.04% for sulfate, 0.30% for pyritic sulfur (under 2%), and 0.40% for pyritic sulfur (2% or over).

1973

48680 **APTIC NO. 70409**

Bolton, N. E., R. I. Van Hook, W. Fulkerson, W. S. Lyon, A. W. Andren, J. A. Carter, and J. F. Emery

TRACE ELEMENT MEASUREMENTS AT THE COAL-FIRED ALLEN STEAM PLANT. PROGRESS REPORT. JUNE 1971-JANUARY 1973. *Union Carbide Corp., Oak Ridge, Tenn., Oak Ridge National Lab., Atomic Energy Commission Contract W-7405-eng-26, National Science Foundation Interagency Agreement AEC 40-237-70 and NSF AG 398, 87p., March 1973. 27 refs.*

NTIS: ORNL-NSF-EP-43

The progress of trace element measurements at the Tennessee Valley Authority s Thomas A. Allen steam plant in Memphis, Tennessee is reported. Both in-plant mass balance and environmental (air, soil, and water) measurements were performed for over 50 trace elements to investigate their disposition from coal combustion. Measurements by neutron activation analysis, spark source mass spectroscopy, and atomic absorption spectroscopy yielded an approximate balance for many elements, with exceptions being volatile compounds such as mercury and possibly arsenic. The electrostatic precipitators used in the plant were efficient in removing trace elements from fly ash, with the notable exception of selenium. Samples collected in the environment included: 6-inch soil cores and mosses taken at varying distances from the plant, high-volume atmospheric particulate samples upwind and in the stack plume, atmospheric fallout, ash pond discharge water, sediment and water from a stream receiving ash pond runoff, and Mississippi River water. No appreciable part of the soil element variations observed were attributed to the steam plant since none of the cores showed significant variations with depth for any of the elements. Also, soil concentrations for a number of elements showing variations with distance from the plant were equal to or greater than those found in the fly ash itself. Measurements of the elemental composition of other specimens collected are not yet completed.

48681 **APTIC NO. 70395**

Crentz, William

COAL AND OIL-SHALE PROCESSING AND COMBUSTION ENERGY RESEARCH AND DEVELOPMENT REPORT. *Bureau of Mines, Washington, D. C., Subpanel V on Coal and Shale Processing and Combustion, 459p., Oct. 27, 1973.*

NTIS: WASH-1281-5

The environmental problems associated with large scale development of oil shale processing and combustion are discussed. Reliable stack gas cleanup systems are required to insure that coal can be burned in central power plants in an environmentally satisfactory manner. Simultaneously, new coal combustion techniques must be developed which have greater efficiency t than conventional systems. Stack gas cleanup consumes from 3-7% of the power output of a plant. Pressurized fluidized bed combustion systems must have the capability of higher thermodynamic efficiencies than conventional systems and must avoid power losses in stack gas cleanup.

48682 **APTIC NO. 70806**

Egan, B. A., A. Epstein, M. Keefe, J. Lague, T. Lavery, E. Reifenstein, and B. Willis

DEVELOPMENT OF PROCEDURES TO SIMULATE MOTOR VEHICLE POLLUTION LEVELS (FINAL REPORT). *Environmental Research and Technology, Inc.,* *Lexington, Mass., Federal Highway Administration Contract H and T 7202, ERT Doc. P-343-F, 196p., May 1973. 7 refs.*

NTIS: PB 233938

Procedures developed to predict motor vehicle air quality concentrations in the vicinity of highways as a function of highway design configuration, traffic characteristics, and meteorological conditions are described. The following computerized models were employed to accomplish the above task: a numerical advection-diffusion model based on conservation of pollutant mass and for the prediction of concentrations in the near-field of highways; an advanced Gaussian plume type dispersion model especially appropriate for point and line source representations of ventilation system and roadway emission geometries and for the calculation of concentrations in the far field of highways as well as for long-term average estimates of concentrations; and a versatile computer graphics display program for plan view representations of concentration fields together with geographical features. An extensive field measurement program was performed at six different highway sites to collect air quality data, traffic data, and simultaneous meteorological data for model validation and calibration. The program resulted in the capture of high quality continuous data recordings of carbon monoxide levels. Computer implementation of the models, including the preparation of a user's manual and model usage demonstrations indicated that the models are capable of predicting air pollution potential over a wide range of input quantities.

48683 **APTIC NO. 71150**

Gross, G. P.

GASOLINE COMPOSITION AND VEHICLE EXHAUST GAS POLYNUCLEAR AROMATIC CONTENT (FOURTH ANNUAL (FINAL) REPORT). *Esso Research and Engineering Co., Linden, N. J., Products Research Div., Coordinating Research Council CRC-APRAC Proj. CAPE-6-68, 143p., 1973. 29 refs.*

The Factors controlling emissions of up to 18 species of polynuclear aromatic hydrocarbons (PNA) and of phenols in automotive exhaust were studied in one vehicle without emission controls and in two vehicles with engine modification emission controls. Current (1968 and 1970) engine modification systems reduced PNA emissions by 65-80% relative to the uncontrolled vehicle. Experimental thermal and catalytic control systems previously reduced emissions by 98%. The PNA fuel composition was linearly related to the PNA emission in tests using fuels near zero, the field average, and the field maximum contents of benzo(a)pyrene (BaP) and other PNA species. Increasing the PNA fuel content by factors of four to seven casued three to five-fold increases in emissions of three major PNA species. High oil consumption caused high PNA emissions. Increasing oil consumption 14-fold caused a three-fold PNA increase. Increasing oil consumption 35-fold caused 14 to 113-fold increases in various PNA species. These increases in PNA emission were apparently due to pyrolysis of the consumed oil, rather than to the presence of PNA in the oil. Minor factors were synthesis of PNA from simpler aromatic molecules, increasing the two-ring aromatics at constant total aromatic content, and addition of 20% of a heavy catalytic naphtha to the near zero PNA fuel. Fuel lead, fuel phosphorus, and the presence of PNA in engine oil showed no significant effects on PNA emissions. Engine oil accumulated PNA equal to 4-12% of the PNA present in the consumed fuel. The major mechanism of PNA emission was the storage in engine deposits of trace amounts of PNA present in fuel during light-duty engine operation, with subsequent emission during more severe operation. Benzo(a)pyrene was 0.04-0.4% fo the total three-ring to seven-ring PNA in emission samples. Losses of certain chemical reactive PNA species from the emission samples were 52-65% for benz(a)anthracene, benzo(a)pyrene, their alkyl derivatives, and perylene. Correction factors were calculated and used to determine correct BaP emission levels. Phenol was the major phenolic compound emitted, with lesser amounts of cresols and xylenols. (Author summary modified)

48684 **APTIC NO. 71210**

Hull, Andrew P.

AVERAGE EFFLUENT RELEASES FROM U. S. NUCLEAR POWER REACTORS, COMPARED WITH THOSE FROM FOSSIL-FUELED PLANTS, IN TERMS OF CURRENTLY APPLICABLE ENVIRONMENTAL STANDARDS. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1035-1046, 1974. 21 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

The average effluent releases of halogens and particulates from 18 second generation light-water cooled nuclear power plants were evaluated. The data are used to project the effluent releases for a reference 1000 MW(e) boiling water reactor (BWR), pressurized water reactor (PWR), and high temperature gas-cooled reactor (HTGR). The yearly effluent releases at an 80% availability would be: for BWR of gaseous pollutants at 1.66 times 10 to the 6th power Ci, for halogens and particulates 5.31 Ci; for PWR of gaseous pollutants at 9650 Ci, for halogens and particulates 0.17 Ci; and for HTGR of gaseous pollutants at 2760 Ci, for halogens and particulates less than 0.02 Ci. These and the amounts of effluents released from reference 1000 MW(e) fossil-fueled plants are compared in terms of relative environmental concentrations and their relationships to the applicable environmental standards for the principal constituents in their respective plant air-effluent streams. (Author abstract modified)

48685 **APTIC NO. 70464**

Mahoney, James R.

EVALUATION OF AN OCEAN BASED SOLID WASTE DISPOSAL SYSTEM: AIR POLLUTION CONTROL ASPECTS. *In: Municipal Waste Disposal by Shipborne Incineration and Sea Disposal of Residues. Harvard Univ. School of Public Health, Boston, Mass., Environmental Protection Agency Grant UI-00557, Rept. EPA-670/2-73-017, p. 463-541, 1973. 22 refs.*

NTIS: PB 221684

An evaluation of the effects of off-shore municipal waste incineration on coastal air quality, with particular reference to the Boston Harbor region, is presented. Factors evaluated include: atmospheric transport patterns, the relationship of daily and seasonal air pollution concentrations to prevailing weather conditions, and operational constraints associated with adverse weather conditions. The contribution of off-shore incineration products to the typical urban atmospheric pollutant load is negligible. Time scheduling of the disposal operation therefore need not be restricted by the time variability of pollutant concentrations in the urban atmosphere. During very unfavorable atmospheric conditions, incineration of 100 tons/hr of municipal waste 10 km offshore might result in concentrations of 20 microgram/cu m along a few km of the shoreline. However, most of the time these operating conditions would result in concentrations of less than 5 micrograms/cu m along the shoreline. Offshore incineration within 10 mi of the shore might require temporary suspension during forecast periods of atmospheric stagnation accompanied by persistent onshore winds.

48686 **APTIC NO. 70405**

Parks, Donald J.

FORMATION OF NITRIC OXIDE IN FLUDIZED BED COMBUSTION. *Minnesota Univ., Minneapolis Dept. of Mechanical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-10,562, 1973, 214p. 39 refs.*

Mixtures of propane and air were burned in a fluidized bed of sand to study the amount of nitric oxide formed and to investigate factors which affect the nitric oxide formation in this type of combustion process. The thermal formation of nitric oxide from the nitrogen in the combustion air was quite low compared with its formation from other combustion processes and was reduced by changes in operating parameters which diluted or dispersed the combustion (leaning the fuel-air mixture or burning less mixture over the same cross section). Changes in the fluidized bed combustor operating parameters which effected heat transfer within the bed did not significantly influence the nitric oxide formation. Particle size had an indirect influence on nitric oxide formation through its determination of the gas flow rate operating range. Experiments investigating the effect of fuel nitrogen on nitric oxide formation revealed that when fuel-air ratios were stoichiometric or lean, nitric oxide was able to pass through the bed unaffected by the combustion process or by contact with the hot sand particles. Most of the nitrogen in ammonia or dimethylamine added to the fuel-air mixture was directly oxidized to nitric oxide. Partial reduction of nitric oxide through the bed was achieved at fuel-air mixtures rich of stoichiometric. The addition of nickel powder to the bed under fuel-rich conditions caused a dramatic reduction in nitric oxide formation.

48687 **APTIC NO. 70830**

Van Loan, M. and Larry Resnick

IMPACT OF EMISSIONS FROM FARM EQUIPMENT AND OFF-ROAD HEAVY DUTY EQUIPMENT ON AIR POLLUTION IN CALIFORNIA. *Preprint, Society of Automotive Engineers, New York, 16p., 1973. 14 refs. (Presented at the Society of Automotive Engineers National Combined Farm, Construction, and Industrial Machinery and Fuels and Lubricants Meetings, Milwaukee, Wis., Sept. 10-13, 1973, Paper 730830.)*

An emissions inventory of mobile and semi-mobile farm equipment and off-road heavy duty equipment in California is presented, with comparisons being made between these two uncontrolled sources and all sources in the state. Hydrocarbon, carbon monoxide, nitrogen oxide, sulfur oxide, and particulate emissions from farm equipment account for 30, 507, 66, 5, and 6 tons/day, respectively, as compared to 7260, 25,300, 3390, 764, and 1470 tons/day from all sources. Off-road heavy-duty equipment accounts for 31, 449, 107, 13, and 12 tons/day of the above pollutants, respectively. Thus, both sources do not constitute major emissions contributors to California s air pollution problems.

48688 **APTIC NO. 70893**

Walker, Harry M.

NOX FORMATION DURING THE INCINERATION OF NITROGENOUS RESIDUES. *Preprint, American Inst. of Chemical Engineers, 20p., 1973. 12 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 74th, New Orleans, La., March 12, 1973.) (Page 1 not available. Summary of article in AIChe Symposium Series, 69(135):164-165, 1974 (?) substituted.)*

Nitrogen oxide formation during the incineration of nitrogenous residues such as hydrogen cyanide, acrylnitrile, ammonia, and oil was studied. A stack sampling program was initiated to determine the relationship of the NOx emissions to the fuel nitrogen content. The loss of NOx as a percent based on the nitrogen content of the fuel was less than 3% in tests with various fuels. As NOx emission sources, the incinerators were quite small, about 40% below the minimum source size controlled by the Texas NOx regulation. A bench scale incineration unit was used to study the differences between the results and those of Turner who reported 40-70% NOx yields on fuel nitrogen. Early experiments with the system indicated that very high levels of NOx could be produced. In order to better approach plant incinerator performance and to mimimize fuel/oxygen mixing rates, a standard burning procedure was adopted and used to test 12 fuels for NOx yields. The highest NOx yields were obtained with low fuel feed rates; at high rates the yields were reduced. The excess air ratio was also important. The results of tests with different fuels are discussed, and reaction mechanisms are reviewed. Fuel nitrogen represents a source of reactive N species without the energetic and stability limitations of the N2 molecule. However, their oxidation does require a ready source of oxygen in some form. These N species are certainly reactive and can readily convert to N2 via a variety of reactions. The difference is a matter of diffusion time. In the bench unit the diffusion distance the oxygen was required to traverse to the center of the flame was, at most, 1 cm. In the plant units this distance was, perhaps 7 ft. In the plant incinerators the reactive N fragments from the fuel mostly convert to N2 before they have the opportunity to encounter an O2 molecule or an O atom. In the bench unit, due to easier diffusion of the O2 across a much shorter distance, a larger fraction of the N fragments find oxygen and become nitric oxide.

48689 **APTIC NO. 70898**

Electricite de France, Service de la Production Thermique

PREVENTION OF OPERATING NUISANCES. *(Prevention des nuisances d exploitation). Text in French. 82p., July 1973.*

The state of the art of the environmental impact of power plants in France is surveyed. Some 52% of all power plants are equipped with electrostatic precipitators, another 0.2% with mechanical dust separators, while 47.6% are operated without dust emission control. The respective ratios of solid as well as liquid, gaseous, and nuclear fuels in energy generation are 21.6% and 78.4%. The regular inspections of the dust separators in coal-fired power plants revealed dust separation efficiencies ranging from 76.1 to 99.6%. The efficiency of electrostatic precipitators for fly ash was between 89.6% and 99.8%.

1972

48690 **APTIC NO. 71233**

Dunbar, R. B., J. C. Mackid, and D. R. Shaw

A STUDY OF THE MERCURY CONTENT OF ALBERTA PETROLEUM RESERVOIR FLUIDS. *Preprint, Energy Resources Conservation Board (Alberta), 18p., 1972 (?). 17 refs.*

The mercury content of the Alberta, Canada petroleum reservoir fluids was investigated and the literature of Hg pollution is reviewed. Mercury was not detected in most samples of gas, condensate, and formation water from several fields. Maximum Hg emissions are lower than 0.07 lb/day, which is considerably less than the United States proposed standard of 5 lb/day. The most hazardous form of elemental Hg is the vapor which is rapidly absorbed from the lungs into the blood with 70-80% of the vapor being absorbed. The vapor has a high affinity for brain and nerve cells. Although fossil fuels contain small amounts of Hg which are released on combustion, the total amount is considerable. Little of the Hg is trapped with the fly ash and the gaseous Hg is washed from the air by rain. Rainwater averages about 0.2 ppb Hg. A threshold limit was proposed for Hg vapor, airborne Hg salt, and organic compounds other than alkyl Hg at 0.05 mg/cu m of air. For alkyl Hg compounds, the proposed maximum allowed allowable concentration is 0.01 mg/cu m.

1971

48691 **APTIC NO. 70475**

Slaminski, John M.

STEAM-ELECTRIC UNIT OPERATING PARAMETERS IN RELATION TO THE EMISSION OF PARTICULATE MATTER, SULFUR DIOXIDE, AND NITROGEN OXIDES. *Preprint, American Inst. of Chemical Engineers, New York, 45p., Dec. 28, 1971. 8 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 72nd, St. Louis, Mo., May 21-22, 1972.)*

Parametric information is developed relating the emission of particulate matter, sulfur dioxide, and nitrogen oxides to steam-electric unit operation as a function of fuel properties, flue gas conditions, and excess combustion air. Corrections are provided for flue gas moisture content and temperature (for particulate matter), since pollutant concentrations are measured at standard conditions on a dry basis. An additional correction for excess combustion air dilution of pollutant concentrations is given as reflected by deviations in flue gas oxygen concentrations from a conventional value of 3%. Corrections that are not based on complete flue gas analyses are not accurate and are not recommended. Pollutant mass emissions are not a function of flue gas conditions or air dilution and represent a superior approach to reporting emissions. Emissions of particulate matter and sulfur dioxide are parametrically related to fuel heating value and ash or sulfur content. The interrelations of pollutant mass emissions based on electrical energy output and heat input with flue gas concentrations appear in working curves. The parametric information is also useful in selecting available control techniques. Unit operation at reduced load down to about 70% of capacity can be somewhat beneficial for the suppression of particulate and nitrogen oxide emissions, and increases in emissions for the quantity of electrical energy produced are realized below 50% of capacity. Sulfur dioxide emissions always increase as load is dropped, and a similar behavior is shown for particulate emissions contrôlled by scrubbers. Particulate and NOx emissions from new units may exhibit a diminutive reduction with load turn down where very high efficiency precipitators and combined combustion modifications are employed. Consideration of all facets of emission behavior with load reductions, as well as economic factors, leads to the conclusion that reduced load operation is generally not the best approach to air pollution control and should be applied with restraint. (Author summary modified)

48692 **APTIC NO. 71254**

Smith, Frederick, Deborah Fairbanks, Ronald Atlas, C. C. Delwiche, Douglas Gordon, William Hazen, Dian Hitchcock, David Pramer, John Skujins, and Minze Stuiver

CYCLES OF ELEMENTS. *In: Man in the Living Environment. Report of the Workshop on Global Ecological Problems. Inst. of Ecology and Wisconsin Univ., p. 42-89, 1971. 55 refs.*

The human activities which may affect the cycles of phosphorus, sulfur, and nitrogen are production for industrial or agricultural use, inadvertent release from other activities, and secondary concentrations following man s use of these elements. Since potential supplies of phosphorus will be exhausted before the end of the 21st century, an international agency should be established to advise on the prudent production, distribution, and use of the phosphate resources of the world which are important for fertilization. Phosphorus is the only major nutrient that has no atmospheric circulation and cannot be replenished by interaction between the air, water, and living systems. The rapidly increasing use of nitrogenous fertilizers (now 11% per year) has doubled the world rate of nitrogen fixation. This increase has been so rapid that the effect on nitrate levels in groundwater remains to be assessed, but elevated nitrate levels are known to be a hazard to animals and to man. Monitoring data of nitrate in groundwater should be collected systematically from the same wells over periods of years and analyzed regionally for trends. Health standards for nitrates in drinking water should be examined and world levels established. The natural emissions of several nitrogenous gases into the atmosphere are not known. But there are probably only trivial sources of nitrogen oxides compared to those produced in combustion chambers. The flow of ammonia from the land and the sea to the air is indicated by levels observed in the atmosphere, but it has not yet been measured. Man may have doubled the atmospheric cycle of sulfur, which could have a significant effect on the abundance of particulates in the atmosphere. Sulfur oxides from fossil fuel combustion appear to be the largest single source of sulfur in the atmosphere. The biological production of sulfur as hydrogen sulfide, which oxidizes rapidly to sulfate, may be increasing due to water pollution. More information is needed on the global effects of sulfur and on geochemical cycles. Global monitoring programs should be organized to provide improved global estimates of the rates of flow and pool sizes in the biogeochemical cycles of elements essential to life.

1963

48693 **APTIC NO. 70448**

Mukhopadhyay, Ahangjit

AIR POLLUTION BY AUTOMOTIVE SOURCE IN URBAN CENTRES, WITH REFERENCE TO ATHENS METROPOLITAN AREA. *Athens Technological Inst., Athens (Greece), Graduate School of Ekistics, Athens Center of Ekistics Research Rept. 8, 198p., Aug. 25, 1963. 54 refs.*

Air pollution by automotive sources in the Athens, Greece, metropolitan area is described and compared with the State of California. Automotive sources are responsible for 65% of the total hydrocarbons and 90% of the carbon monoxide contamination in California. The rate of increase of automobiles and traffic volume have multiple effects in increasing the concentration of contaminants in the atmosphere. No air quality measurements have been made in Athens. Levels of concentration were estimated in the Athens metropolitan area for CO at 20 ppm compared to actual measurement of 25-45 ppm in Los Angeles; for hydrocarbons at 0.5 ppm compared to 1.1 ppm in Los Angeles; sulfur dioxide at 0.25 ppm compared to 0.5 ppm in Los Angeles; ozone at 0.1 ppm compared to 0.3 ppm in Los Angeles; and oxidant at less than 0.05 ppm compared to 0.5 ppm in Los Angeles. When the Athens data were projected for 1975, levels were above the maximum allowable concentrations standards set by the State of California. Control programs and methods are discussed.

CONTROL METHODS

1975

48694 **APTIC NO. 70992**

Bettelheim, J. and A. C. Collins

DRY LIMESTONE TECHNIQUES FOR LIMITING SO2 EMISSION. ASSESSMENT OF LARGE SCALE APPLICABILITY. *Chem. Ind. (London), no. 3:122-124, Feb. 1, 1975. 6 refs.*

The applicability and economic feasibility of using dry limestone scrubbing techniques in Great Britain for the removal of sulfur dioxide from flue gases is reviewed. Basic assumptions in the assessment include a steam electric plant of 2000 MW capacity, an 18% (weight) ash content of coal, a 1.9% (weight) sulfur content of coal, a sulfur dioxide removal efficiency of 50%, and a limestone utilization of 25%. The two major capital cost factors are the extension to electrostatic precipitators for particulate control and the necessity of an ash/lime disposal system. The major single item in overall operating cost is the cost of delivered raw material. Surveys of the American limestone industry indicate a price range of $1 to $2/ton of delivered lump limestone. Comparisons are given between British cost estimates and those of the Tennessee Valley Authority in America.

48695 **APTIC NO. 71128**

Bischoff, W. F., Jr. and Peter Steiner

COAL CONVERTS SO2 TO S. *Chem. Eng., 1975:74-75, Jan. 6, 1975.*

A Resox process for the conversion of sulfur dioxide in flue gas to marketable, high-purity, liquid sulfur using coal as the reductant is described. The process involves a reactor and a condenser basically to achieve the conversion. The Resox reactor is a shell completely filled with coal (rice-size particles, preferably anthracite). The coal enters the reactor by gravity through a feeding tube and rotary airlock valve, moving slowly downward in the vessel and exiting through a magnetic-drive vibratory feeder that controls bed level. The SO2 stream flows countercurrently, after injection with air at several ports distributed around the lower vessel circumference. Gas residence time in the atmospheric-pressure reactor runs 3-4 sec, converting 90-95% of SO2 to S. Reaction temperature ranges between 1100 and 1500 F, near the higher figure for anthracite coal and near the lower end for bituminous coal. After exiting from the top of the reactor, the gas stream passes to an inclined (about 5 degree) shell-and-tube condenser similar to those in Claus sulfur- recovery units. Sulfur condenses on the tube side at 320 F, while 50-psi steam is generated from boiler feedwater on the shell side. Noncondensing gases which contain some unreacted SO2, hydrogen sulfide, and carbonyl sulfide can be incinerated completely to SO2 in an external incinerator or by various other means. The unit can handle a total gas flow of 5000-5500 lb/hr SO2. Relatively little coal and electricity are consumed, amounting to about 0.2 lb coal/lb inlet SO2 and 0.02 kW/lb SO2. The estimated capital cost for Resox is $6.50/kW for a 500 MW powerplant burning coal with 4.3% S.

48696 **APTIC NO. 71037**

Drew, J. W.

DESIGN FOR SOLVENT RECOVERY. *Chem. Eng. Progr., 71(2):92-99, Feb. 1975. 4 refs.*

Design considerations are reviewed for solvent recovery systems. Recovery of solvents emitted into the air usually requires pre-filtering and cooling of the air stream, adsorption of the solvent on activated carbon, desorption by steam, and finally purification by distillation. Decanting and extraction are often added where partially water-miscible solvents are involved. Absorption in water is sometimes an alternative to adsorption on carbon, though economic recovery with water absorption cannot be achieved for dilute mixtures of solvent vapors in air. Absorption in oil, which requires stripping and recycling of the oil, can be more economical than carbon adsorption where the solvent is reactive on activated carbon or boils too high to desorb well. Specifications for recovered solvents which can normally be met economically are: water content of solvent, 0.05-0.5% cross mixing of solvents, 0.5-5%; and organic content of waste water, 10-100 ppm. The design of a solvent recovery system for the emission of methylene chloride and methanol from a resin processing dryer is presented to illustrate various solvent recovery techniques, with material balance and cost considerations being included.

48697 **APTIC NO. 71083**

Firman, J. E.

AIR FILTRATION AND CLEAN ROOMS. *Filtration Separation (Purley), 1975:53-54, 56, 58, 60, Jan./Feb. 1975. 7 refs. (Presented at the Filtration Society s Conference on The Contribution of Consultants to Filtration Engineering, Stoke-on-Trent, England, Oct. 1, 1974.)*

Principles of indoor air filtration are reviewed. Topics include: air flow patterns, temperature and humidity considerations, air filtration, air conditioning systems, and clean-air modules for various industrial activities. The use of laminar air flow as opposed to turbulent air flow offers the advantages of less particle entrainment and agglomeration and more rapid removal of dust contamination generated in a room. Laminar air flow type rooms are also self-cleaning. Although more expensive initially, laminar air flow systems provide more economical operation and maintenance of indoor atmospheres at low contamination levels. Laminar flow modules can be designed to provide clean or sterile down-flow areas over a variety of industrial operations also (assembly lines, machines, work benches). Terminal air filters of the ultra high efficiency type are recommended laminar flow rooms. Such filters allow less than 0.003% penetration of sodium chloride test aerosol at their maximum flow rates.

48698 **APTIC NO. 71434**

Gebica, Marian

THE ADEQUATE FILTRATION SPEED IN THE CLOTH FILTER AS DIMENSIONING FACTOR FOR THE FILTER SIZE. *(Die richtige Filtrationsgeschwindigkeit im Gewebefilter als Bemessungsfaktor fuer die Filtergroesse). Text in German Staub, Reinhaltung Luft, 35(2):56-59, 1975. 2 refs.*

A simple mathematical model for selecting air flow velocity for air filters of various dimensions is described. The parameters of the equation derived include the gas dust loading, air to cloth ratio, dust mass on the filter, and the filter drag. The values of the coefficients were obtained from information in American surveys. Further experimentation will be required to establish the constants in the equation.

48699 **APTIC NO. 70557**

Hirst, Eric

ENERGY IMPLICATIONS OF CLEANUP OPERATIONS. *Environ. Sci. Technol., 9(1):25-28, Jan. 1975. 5 refs.*

Environmental quality considerations limit fuel supplies to those that can be extracted and burned in environmentally acceptable ways, however, large amounts of energy are required to operate pollution control systems. These factors cause environmental control to require additional fuel usage and to add to the energy crisis. Energy requirements for environmental improvement are 3.5-4.0% of total energy use. However, the quantities of energy required to achieve various environmental quality goals are relatively small. For example, the 840 trillion tu estimated for air pollution control at stationary sources is only 1.2% of total 1970 energy use. At an annual energy growth rate of 3.5%, this represents 4 month s energy growth in 1970. The sum of all increased energy costs amounts to about 1 year s normal growth in energy use. This suggests that present energy growth rates cannot be attributed to operation of environmental protection systems. Energy needs for environmental protection can be more than offset by various conservation measures. Increased recycling, generation of electricity with solid waste, a shift from autos to mass transit, redesign of autos to improve fuel economy, and increased building insulation could significantly reduce energy growth. Such energy conservation measures would reduce pollution, conserve scarce energy resources, and generally save money for consumers. The conclusions in regard to primary energy closely correspond to those for electric energy. The energy implications of urban passenger transport, wastewater treatment, solid waste management, air pollution abatement, and waste heat dissipation are specifically discussed (Author abstract modified)

48700 **APTIC NO. 71085**

Reiquam, Howard, Norbert Dee, and Paul Choi

ASSESSING CROSS-MEDIA IMPACTS. *Environ. Sci. Technol., 9(2):118-120, Feb. 1975. 1 ref.*

The cross media impacts of environmental control strategies (e.g., the effect of air quality control on land and water quality) are mathematically analyzed. A procedure for calculating a Strategy Effectiveness Index is outlined, using a 1000 MW coal-fired power plant as an example. All relevant waste streams that will be affected by a given control strategy are first identified. The production rates of all pollutants are then determined for the uncontrolled case and for each control strategy being considered. Baseline data for the uncontrolled production of pollutants are generated for air pollutants (nitrogen oxides, sulfur dioxide, carbon monoxide, fly ash, total organic material, and heat), water pollutants (suspended solids, dissolved solids, total organic material, inorganics, and heat), and land pollutants (ash). Damage functions are constructed based on the maximum production rate of each pollutant. The damages are then modified to account for the behavior of pollutants in terms of persistence, mobility, and transfer to other environmental media. Next, the relative importance of individual pollutants is assigned as a proportion of the relative importance of the three environmental media, using weights obtained from judgments of Environmental Protection Agency personnel. An Environmental Degradation Index for the controlled and uncontrolled state is calculated based on the environmental damage created by the discharged pollutant and the significance of the damage. The Strategy Effectiveness Index is then found by subtracting the controlled from the uncontrolled Environmental Degradation Index.

48701 **APTIC NO. 70381**

Schwarzmann, M.

METHANOL: SYNTHETIC RAW MATERIAL AND SOURCE OF ENERGY? *(Methanol: Syntheserohstoff und Energietraeger)? Text in German. Chem.-Ing.-Tech., 47(2):56-61, 1975. 14 refs.*

The future employment of methanol as a source of energy has been increasingly discussed in the last few years. Attention has been mainly directed to the use of the currently flared petroleum gases and to the clean-air use of coal via methanol. Closer examination shows, however, that the detour via methanol is unfavorable from the energy point of view. This is particularly so as regards utilization of the amounts of natural gas currently flared where transport of liquid gas exists as an alternative. With the ever-increasing price of petroleum gas, the methanol route can no longer compete with the transport of liquid gas. Furthermore, the amounts of gas flared in the Middle East are often overestimated. They correspond to an oil equivalent of 50 million tons per annum and may therefore be disregarded as an alternative source of energy for large consumers. The 50 million tons of methanol obtainable per annum from petroleum gas could, however, be of considerable importance as a raw material for the chemical industry.

1974

48702 **APTIC NO. 71294**

Adair, Paul F.

DECELERATION FUEL FLOW AND EMISSION CONTROL FOR INTERNAL COMBUSTION ENGINES. *(Aerodex, Inc., Miami, Fla.) U. S. Pat. 3,823,699. 5p., July 16, 1974. 9 refs. (Appl. Oct. 20, 1972, 4 claims).*

A device for reducing the fuel/air ratio, preferably below that necessary for combustion, of an internal combustion engine during vehicle deceleration is described. Engine exhaust emissions are decreased and fuel economy increased as a result. The fuel/air ratio is reduced in response to a predetermined negative intake manifold pressure by replacing the conventional idle needle valve with an adjustable needle valve having a longitudinal duct which terminates at its inner end in one or more radial orifices which open into the idle duct upstream of the outlet port. A valve communicates the needle valve duct, and consequently the idle duct, with the atmosphere to decrease the fuel/air ratio of the idle mixture under certain conditions.

48703 **APTIC NO. 71184**

Akhtar, Sayeed, Nestor J. Mazzocco, Murray Weintraub, and Paul M. Yavorsky

SYNTHOIL PROCESS FOR CONVERTING COAL TO NONPOLLUTING FUEL OIL. *Preprint, 17p., 1974. 7 refs. (Presented at the Synthetic Fuels From Coal Conference, 4th, Stillwater, Okla., May 6-7, 1974.)*

The development of the Synthoil process for converting coal to nonpolluting fuel oil is described. Coal is liquefied and desulfurized in one step by catalytic hydrotreatment in a novel turbulent-flow, packed-bed reactor. Coals containing 3.0-4.6% sulfur were converted to oil containing 0.2 to 0.3% S. The oil produced from Kentucky strip coal was a premium grade fuel containing 0.2% S and less than 0.1% ash when the outlet temperature was 450 C. A turbulent flow of hydrogen through the reactor prevents the mineral matter of coal from settling out and plugging the reactor, promotes mass and heat transfer, and helps keep the catalyst surface clean. The process was designed primarily for producing a utility fuel, but it is adaptable to the production of diesel fuel, naphtha, and gasoline.

48704 **APTIC NO. 70903**

Alperovich, M. A. and I. K. Reshidov

DESIGN FEATURES OF THE MODERN FLUE GAS ELECTROSTATIC PRECIPITATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 79-96. (Jan. 15-18, Paper 4.)*

Design features of electrostatic precipitators used in the Soviet Union for flue-gas particulate removal are reviewed. Both horizontal and vertical precipitators are used, depending on the application. The latter are one-field types and can handle initial dust concentrations not exceeding 20 g/cu nm. In both types of precipitators the flow of dust-laden gas is perpendicular to the electric field, and the collector electrodes are located parallel to the axis of the gas inlet. Three types of uniform horizontal electrostatic precipitators are used, with electrode heights ranging from 4.5 m to 12 m and field lengths ranging from 2.5 m to 4 m. Collector electrodes are made of either uniform C-formation elements (350 mm wide) or plate-like assemblies composed of 8 mm steel rods in 15 mm spacings. Corona electrodes are either nichrome wire, belt-tooth, or belt-needle in design. Current carrying parts are insulated from the body of the apparatus by means of quartz piping and porcelain bracket insulators.

48705 **APTIC NO. 71064**

Ambler, Theodore C.

ANTI-POLLUTION COMPRESSOR CONTROL SYSTEM. *(Assignee not given.) U. S. Pat. 3,817,265. 6p., June 18, 1974. 6 refs. (Appl. June 16, 1972, 5 claims).*

An anti-pollution control for compressors used in gas recovery operations is described. An electrical circuit responsive to changes in gas pressure operates a selector valve to return gases, that might otherwise be expelled to the atmosphere, from the unloaders of compressors to the gas recovery system storage tanks. For continuously operating rotary compressors, similar control components alternately establish a no-load bypass for system lines to avoid atmospheric contamination. (Author abstract modified)

48706 **APTIC NO. 71415**

Amery, Ernest

INTERNAL COMBUSTION ENGINE. *(Assignee not given.) U. S. Pat. 3,824,970. 4p., July 23, 1974. 4 refs. (Appl. Oct. 24, 1972, 4 claims).*

A spark ignition internal combustion engine is described that uses a double-headed cylinder to achieve more complete combustion, and hence less unburned exhaust emissions, than existing internal combustion engine designs. The engine is of the piston type, with the piston mechanically arranged for both oscillatory and related vertically reciprocating motion. The cylinder is double-headed, and the heads are oriented with respect to the piston faces such that maximum compression is effected on the firing stroke of the engine. (Author abstract modified)

48707 **APTIC NO. 71077**

Ando, Junpei

WASTE-GAS DESULFURIZATION AND GYPSUM. *(Haien datauryu to sekko). Text in Japanese. Seramikkusu (Ceramics), 9(9):23-29, 1974. 12 refs.*

Electric power companies have recently adopted full-scale waste gas desulfurization chiefly due to improvements in reliability, an increase in the price of low-sulfur oil and its unavailability, and the fact that conditions are favorable for waste gas desulfurization even if an increase in the price of equipment and facilities is considered. The amount of crude oil imported into Japan is 250 million tons in which 4 million tons of sulfur is included, which means that 15 million tons of gypsum, three times the total demand for gypsum per year, is produced. The industrialization of a process in which sulfur dioxide included in waste gas is absorbed into lime slurry and then converted to gypsum was first realized in Japan. The first waste gas desulfurization unit built by Mitsubishi Heavy Engineering Company was, however, faced the difficulty of scaling. Various essential measures to prevent scaling are described in this report. The ammonia lime process, the diluted sulfuric acid process, the sodium lime process, the limestone process using activated carbon, and the sulfate salt process are reviewed along with the properties and use of gypsum produced by these processes.

48708 **APTIC NO. 70869**

Atkins, Richard S.

THE COMMERCIALIZATION OF LIME/LIMESTONE FLUE GAS SCRUBBING TECHNOLOGY. *Preprint, American Chemical Society, Washington, D. C., 20p., 1974. 11 refs. (Presented at the American Chemical Society, National Meeting 167th, Los Angeles, Calif., March 31- April 5, 1974, Paper 37.)*

The application of some of the original technical concepts in today s modern plants for control of sulfur dioxide and the methods used by Research-Cottrell to better meet growing market requirements are presented. A wetted film packing was found which exhibits excellent SO2 absorption with an exceptionally low pressure drop. The packing has outstanding transfer characteristics and high specific surface area. Calcium-based scrubbing technology is employed because it does not require a lot of attention, is inexpensive to operate, needs only moderate capital requirements, and does not take effort from the industry power producing function. In the typical calcium system, flue gases enter a quenching section where the gas is cooled and particulate and some SO2 removal takes place. The quenched gas then enters the absorption section where the remaining SO2 is removed. Fianlly, a mist eliminator section removes water and reagent droplets. The cleaned gas is reheated and returned to the stack. Calcium reagent is added to the absorber tank and pumped to the SO2 absorber. Most of the spent reagent is returned to the absorber tank, and part is provided as reagent make-up in the quencher system. The spent quencher reagent, containing particulate and reaction salts, is removed from the process as a sludge blow down. Make-up water, to compensate for evaporation losses and sludge blow down, is primarily added as mist elminator wash. Important areas in commercial system design include absorption surface selection, control of reagent desupersaturation, reagent pH profiles, and closed loop water balance.

48709 **APTIC NO. 71456**

Atroshchenko, A. V., A. N. Tseytlin, and G. I. Karaputina

PILOT TEST OF A CATALYST FOR THE REMOVAL OF NITROGEN OXIDES FROM EXHAUST GASES. *(Ispytnaiye katalizatora dlya ochistki vykhlopnykh gazov ot okislov azota na opytno-promyshlennoy ustanovke). Text in Russian. Khim. Prom. (Moscow), no. 5:30-32, 1974. 3 refs.*

The optimum conditions for catalytic removal of nitrogen dioxide and nitric oxide from industrial waste gases in the presence of ammonia were studied. Iron oxides with an activator additive were used as catalysts in a temperature range of 250-310 C. The rate of reduction amounted to 99.5% at 280 C, corresponding to a residual nitrogen oxide concentration of 0.003%. The ammonia to nitrogen oxides ratio was optimal between 1.15 and 1.25, while the optimum bulk speed was between 5000 and 13,200/hr. The purified gas satisfied the sanitary standards for both nitrogen oxides and residual ammonia.

48710 **APTIC NO. 70946**

Azuma, K., A. Yoshidome, K. Doi, and S. Yamauchi

DEODORIZATION OF SEWAGE EXHAUST GAS BY OZONE. *(Gesui-shu no ozon dasshu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):472, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 321.)*

An experimental ozone deodorization device consisting of a washing tower using an O3 solution and activated charcoal adsorption was developed for sewage odor treatment. The deodorization procedure includes the addition of about 3 ppm gaseous O3 to exhaust gas, washing with the O3 solution, heating, and treatment with activated charcoal. The sample gas was prepared by adding given amounts of malodors such as hydrogen sulfide, methyl mercaptan, dimethyl sulfide, ammonia, and triethylamine to air. For the field test, the stagnant air in a sewage treatment plant was collected. At a 1 ppm level, NH3 and (C2H5)3N were removed efficiently with water, and the removal rate was above 90% with O3 solution. At a 2 ppm level for H2S, the removal rate was 30-45% with O3 solution. Sulfides and CH3SH are less soluble in water than H2S, and effective removal depends on adsorption by activated charcoal. The odors in field sample were H2S (0.27-0.1 ppm), CH3SH (0.026-0.0105 ppm), (CH3)2S (0.018-0.028 ppm), NH3 (1.53 ppm) and (C2H5)3N (0.018-0.019 ppm), and removal rates were 97-74%, 92-69%, 90-88%, 91%, and 80-40%, respectively.

48711 **APTIC NO. 71278**

Barnard, Richard E. and Wendell E. Miller

THE CAT-OX PROJECT AT ILLINOIS POWER. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 44-53. (Oct. 22-24.)*

Results from a field trial installation of a catalytic oxidation (Cat-Ox) system for removal of sulfur dioxide from flue gases emitted from a 103 megawatt coal-fired unit of the Illinois Power Company are presented. The system appears capable of removing at least 85% of the sulfur dioxide from the flue gas as 78% sulfur acid. It also removes essentially all of the fly ash. Sale of the sulfuric acid may offset some of the operating costs. Operating and maintenance costs are expected to run approximately $962,000/yr. Although start-up and operational problems have kept the system from operating reliably, the principal of operation has been proven.

48712 **APTIC NO. 71073**

Barnebey, Herbert Leonard

WASHED ACTIVATED CHARCOAL ADSORBERS. *(Barnebey-Cheney Co., Columbus, Ohio) U. S. Pat 3,815,335. 6p., June 11, 1974. 3 refs. (Appl. Aug. 20, 1973, 4 claims).*

A charcoal adsorber for the removal of gaseous and particulate contaminants from gas streams is described that incorporates an improved system for washing the adsorbent. The liquid flow is at right angles to the gas flow. The apparatus comprises several vertically-extending granular activated carbon adsorption zones and several open gas flow channels which provide gas flow through the adsorption zones in a horizontal direction. A set of liquid spray nozzles is provided above the adsorption zones for supplying a liquid such as water downwardly through the activated carbon between adsorption steps. A liquid collecting floor receives and discharges the liquid drained from the adsorption zones.

48713 **APTIC NO. 71258**

Beckwith, William F.

DISPOSAL OF KRAFT MILL ODOROUS GASES. Preprint, 17p., 1974. 2 refs. (Presented at the Air Water Pollution Control Seminar, 10th, Clemson, S. C., Dec. 5, 1974.)

The formation, sources, and control of odorous gases from kraft mills are reviewed. The odorous gases are hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. A noncondensible gas system for abatement of the odors is described. It consists of a collection operation and an incineration operation. Separate systems for high concentration, low volume streams and for low concentration, high volume streams are required. In most abatement operations the odors are burned in either a lime kiln or a separate incinerator. Collection systems differ for a mill which used a batch digester compared to a mill with continuous digesters. The collector is designed according to the sources, the potential hazard of piping explosive gas mixtures, the concentration of moisture in the gases, corrosive gases being collected, and other considerations. A method to burn low concentration, high volume source gases in a recovery boiler is being studied. In some noncondensible gas systems, a white liquor scrubber is included. Air pollution control by the noncondensible gas systems is effective, but expensive, with no reduction of mill operating cost or increase in the quality of the paper produced to offset the increased pollution control expenses.

48714 **APTIC NO. 71060**

Betz, Erwin C.

CATALYTIC INCINERATION APPARATUS. *(Assignee not given.) U. S. Pat. 3,817,716. 4p., June 18, 1974. 8 refs. (Appl. Nov. 18, 1971, 10 claims).*

A catalytic incineration device for the treatment of industrial waste gases containing hydrocarbons is described. The device comprises a catalytic cracking chamber and a catalytic oxidation chamber. Any conventional cracking catalyst may be employed, though the waste gases must be at a temperature of at least 85 C before coming into contact with the cracking catalyst. Oxidation catalysts having a metallic base are preferred for the oxidation chamber. The oxidation catalyst surrounds the cracking chamber and is positioned to permit gases to flow radially into the space between itself and the cracking chamber.

48715 **APTIC NO. 70913**

Billings, Charles E. and John E. Wilder

MAJOR APPLICATIONS OF FABRIC FILTERS AND ASSOCIATED PROBLEMS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 329-372. 15 refs. (Jan. 15-18, Paper 15.)*

Results from a survey of several industrially-operating fabric filter systems are presented. Particle sizes being removed by such filters range from below 2 micron to over 200 micron. Filter sizes range from 100-100,000 sq ft. Specific dust fabric filter resistance coefficients vary from 1-1000, depending on parameters such as particle size, application, and fabric construction. Capital costs range from 1 to greater than 20 dollars/cfm, and maintenance costs range from 0.10-1 dollar/cfm/yr. Reported bag life ranges from a few months to greater than 10 yr. Most users report satisfactory overall operation. The majority of operating problems reported are associated with the fabric. The efficiency of fabric filters in service is largely unknown. Visual criteria reported relate to concentrations of the order of 0.02 grains/cu ft.

48716 **APTIC NO. 71072**

Bobrowsky, Charles A. and Joseph A. Loise

GAS SCRUBBER AND METHOD. *(Double B Construction and Incinerator Upgrading Co., Inc., Brooklyn, N. Y.) U. S. Pat. 3,815,332. 4p., June 11, 1974. 6 refs. (Appl. March 28, 1972, 5 claims).*

A gas scrubber that is particularly suited for removing entrained solids from incinerator smoke is described. The scrubber housing contains a water bath, a pair of spaced baffles which extend from the top of the housing to below the water bath level, and a third baffle which extends from the bottom of the housing to above the water level. The interior of the housing is thus divided into a receiving zone, a turbulent zone, and a discharge zone. Gases containing entrained solids are passed through the scrubber and undergo a tortuous path in and out of the water bath, resulting in the removal of solid contaminants. (Author abstract modified)

48717 **APTIC NO. 71493**

Buchwald, Robert M.

COOLANT TEMPERATURE RESPONSIVE EXHAUST CROSSOVER VALVE SYSTEM. *(General Motors Corp., Detroit, Mich.) U. S. Pat. 3,814,071. 5p., June 4, 1974. 6 refs. (Appl. March 2, 1973, 2 claims).*

An exhaust crossover valve system which permits the utilization of internal combustion engine exhausts for promoting vaporization of the fuel at the intake passages is described that provides for automatic closing of a crossover passage from the exhaust manifold to the combustion chamber when the engine reaches a preset operating temperature. The crossover passage is regulated by a pair of valves controlled by a thermosensitive motor which is responsive to engine coolant temperature. The valves divert the exhaust gases through the crossover passage during engine warmup to promotive greater fuel vaporization in the intake air-fuel mixture. As the engine coolant temperature rises, the valves are actuated in phase opposition by the thermosensitive motor to gradually close the crossover passage and open the passage to the exhaust manifold. Thus, the overheating of the intake air-fuel mixture is prevented when the engine reaches a given operating temperature. (Author abstract modified)

48718 **APTIC NO. 70474**

Burovoi, I. A., A. A. Ashimov, and V. P. Morozov

DIGITAL SYSTEM FOR OPTIMAL CONTROL OF OXIDATION OF SULFUR DIOXIDE. *(Tsifrovaya sistema optimal nogo upravleniya protsessom okisleniya sernistogo angidrida). Sov. Chem. Ind. (English translation from Russian of: Khim. Prom.), 6(6):396-401, 1974. 6 refs.*

The development and industrial adoption of a digital system for optimum control of sulfur dioxide oxidation are described. The process was carried on in two four-bed contact units working on tail gases from a sintering plant of the nonferrous metals industry. The high rate of change of gas input and the wide range in which the SO2 content varied, and the considerable inertia of the contact unit, made it difficult to apply control systems using active search and realizing the optimal conditions by the use of extremal controllers or evolutionary design methods. A possible solution was to synthesize automatic systems using an adaptive dynamic mathematical model of the technological process to seek the optimal conditions. The development of the algorithm of optimal control of the process using an adaptive dynamic model and the synthesis of a multidimensional system of direct digital control that will bring the object of control into the working region and then maintain the calculated optimal conditions are discussed. The adoption of this system of digital optimal control made it possible to increase the degree of contacting by 0.81% under conditions of constantly fluctuating sulfur dioxide concentration in the inlet stream and to raise the productivity of the contact units with respect to SO2 oxidized.

48719 **APTIC NO. 70908**

Calvert, Seymour

SCRUBBER PERFORMANCE FOR PARTICLE COLLECTION. *United States-USSR Working Group, Stationary*

Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 189-212. 4 refs. (Jan. 15-18, Paper 9.)

Major scrubber types are discussed in relation to their particulate collection efficiency, with particular emphasis being placed on the inertial impaction separation process. High collection efficiency for sub-micron particles requires the expenditure of high pressure drop when particle collection is due to inertial impaction only. High efficiency scrubbing of such particles at moderate pressure drop is possible when particle separation forces which are not dependent on gas velocity are applied. Particle separation phenomena which offer promise include: diffusiophoresis, thermophoresis, electrophoresis, and Brownian diffusion. Particle growth by any of several mechanisms can also provide the means for subsequent high efficiency collection by inertial impaction.

48720 **APTIC NO. 70397**

Cato, G. A., H. J. Buening, C. C. DeVivo, B. G. Morton, and J. M. Robinson

FIELD TESTING: APPLICATION OF COMBUSTION MODIFICATIONS TO CONTROL POLLUTANT EMISSIONS FROM INDUSTRIAL BOILERS - PHASE I (FINAL REPORT). *KVB Engineering, Inc., Tustin, Calif., Environmental Protection Agency Contract 68-02-1074, Program Element 1ABO14, Rept. EPA-650/2-74-078-a, ROAP 21BCC-046, SN-6000-28, 215p., Oct. 1974. 24 refs.*

NTIS: PB-238 920/AS

The effectiveness of combustion modification techniques to control emissions of nitrogen oxides from industrial boilers of 10,000 to 500,000 lb of steam/hr capacity was investigated. Measurements of particulate loading, sulfur oxides, hydrocarbon, carbon monoxide, carbon dioxide, and smoke spots were made under both normal and reduced NOx emission firing conditions to establish the magnitude and trend of outputs at different conditions. Nitrogen oxides reductions were achieved by off- stoichiometric combustion, for multiple burner units by changes in excess air level, burner adjustments, or other operational parameters. Base load NOx emissions for coal fired boilers varied from 224 to 800 ppm. For oil-fired boilers emissions varied from 100 to 200 ppm, while for natural-gas-fired boilers emissions varied from 50 to 375 ppm. Emission data on the other pollutants in coal, oil, and natural gas boilers are included.

48721 **APTIC NO. 71059**

Cavallero, Louis Thomas and Walter Joseph Elnicki

HYDROCARBON OXIDIZER SYSTEM. *(Aer Corp., Ramsey, N. J.) U. S. Pat. 3,817,687. 9p., June 18, 1974. 3 refs. (Appl. July 18, 1973, 15 claims).*

A pollution-free system for disposing of gasoline vapors at a tank truck loading station is described that is appreciably less expensive than prior-art vapor condensing systems. Recovered liquid from vapor condensing operations is unusable as gasoline due to its high impurity content, thus leading to its disposal as waste. The present system disposes of the gasoline vapors directly and in a safe manner. A booster pump energized in response to the pressure within a conventional vapor saver tank feeds the vapors from the tank through a control valve to a supply line of hydrocarbon oxidizer. The vapor flow to the oxidizer is regulated in response to the temperatury in the oxidizer. (Author abstract modified)

48722 **APTIC NO. 71131**

Cedarholm, Oscar R.

VEHICLE FUEL INJECTOR. *(Assignee not given.) U. S. Pat. 3,814,391. 7p., June 4, 1974. 9 refs. (Appl. Jan. 10, 1972, 10 claims).*

A timed fuel injector and carburetor assembly capable of reducing engine exhaust emissions by cutting off unnecessary charges of fuel is described. The device also achieves thorough atomization of fuel and thus greater combustion efficiency. External air and a charge of augmented air from an air booster are directed through carburetor passages defined by a series of spaced horizontally oriented guide plates. Fuel picked up the uppermost stream of air is driven over a series of ribs where it is successively impinged and atomized at different levels by the incoming streams of air. The substantially atomized air- fuel mixture is then forced through a series of downstream guide plates for further atomization. A special fuel injection mechanism in conjunction with a relay valve operates to quickly cut off the supply of fuel when there is a temporary lack of demand for the fuel. (Author abstract modified)

48723 **APTIC NO. 71040**

Christman, Robert D., George E. Elliott, Jr., Joel D. McKinney, and Geoffrey R. Wilson

RESIDUE HYDRODESULFURIZATION PROCESS WITH CATALYSTS WHOSE PORES HAVE A SMALL ORIFICE SIZE. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,814,684. 7p., June 4, 1974. 3 refs. (Appl. June 14, 1972, 8 claims).*

A process for the hydrodesulfurization of crude oil or reduced crude oil containing an asphaltene fraction is described. The oil and hydrogen are passed over a catalyst consisting of at least one Group VI metal and at least one Group VIII metal on alumina at a throughput of no greater than 34 barrels of oil/lb catalyst. The catalyst pore volume is at least 0.40 cc/g. The pore radius of the catalyst at which one-half of the total pore volume is filled with liquid nitrogen in a liquid nitrogen desorption isotherm measurement is between 40 and 58 A. The pore radius at which one-half of the total pore volume is filled with liquid nitrogen in a preceding adsorption portion of the same isotherm measurement is between 15 and 30 A higher than the desorption measurement. The relative dimensions of the pore structure are adapted to provide a predetermined balance between catalyst activity and long catalyst life. (Author abstract modified)

48724 **APTIC NO. 71135**

Christman, Robert D., Joel D. McKinney, and Geoffrey R. Wilson

HYDRODESULFURIZATION PROCESS WITH CATALYSTS WHOSE PORE SIZES ARE CONCENTRATED IN A NARROW RANGE. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,814,683. 10p., June 4, 1974. 6 refs. (Appl. June 14, 1972, 20 claims).*

A process for the hydrodesulfurization of a crude oil, a reduced crude oil, or a heavy gas oil employing catalysts with a high proportion of pores in a narrow range of relatively large pore sizes is described. An advantage of concentrating a high proportion of the total pore volume of the catalyst in a narrow pore size range is the avoidance of an excessive pore volume. The process consists of passing the oil along with hydrogen over a catalyst consisting of at least one Group VI metal and at least one Group VIII metal on alumina. The catalyst pore volume is at least 0.40 cc/g. At least 65% of the pore volume is within the size range of 40-90 A, as determined by isothermal liquid nitrogen desorption measurement. (Author abstract modified)

48725 **APTIC NO. 71136**

Christman, Robert D., George E. Elliott, Jr., Joel D. McKinney, and Geoffrey R. Wilson

RESIDUE HYDRODESULFURIZATION PROCESS WITH CATALYSTS WHOSE PORES HAVE A LARGE ORIFICE SIZE. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,814,682. 7p., June 4, 1974. 4 refs. (Appl. June 14, 1972, 7 claims).*

A process for the hydrodesulfurization of a crude oil or a reduced crude oil containing an asphaltene fraction employing catalysts whose pore structure possesses relative dimensions adapted to provide a predetermined balance between catalyst activity and long catalyst life is described. The oil along with hydrogen is passed over a catalyst containing at least one Group VI metal and at least one Group VIII metal on alumina at a throughput of at least 34 barrels of oil/lb catalyst. The catalyst pore volume is at least 0.40 cc/g. The pore radius of the catalyst at which one-half of the total pore volume is filled with liquid nitrogen in a liquid nitrogen desorption isotherm measurement is between 58 and 80 A. The pore radius of the catalyst at which one-half of the total pore volume is filled with liquid nitrogen in a preceding adsorption portion of the same isotherm measurement is at least 15 A higher than the desorption measurement but not higher than 114.6 A. (Author abstract modified)

48726 **APTIC NO. 71277**

Cochran, Neal P.

COAL LIQUEFACTION. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 37-43. (Oct. 22-24.)*

Office of Coal Research activities involving the development of coal liquefaction processes are reviewed, and a process combining pyrolysis and hydrogenation to yield a liquid product is described. A synthetic crude or low-sulfur boiler fuel can be obtained by the low temperature carbonization or pyrolysis of coal to yield a crude liquid product which can then be hydrogenated. Direct hydrogenation, which produces the largest quantity of liquid per ton of coal fed, can be carried out using a fixed-bed catalyst system or an ebullated bed. About three barrels of liquid product are produced per ton of coal. Typical high-sulfur bituminous coals can be converted to a low-sulfur liquid product with a sulfur content ranging from 0.1% to 1.0% depending on operating conditions.

48727 **APTIC NO. 71377**

Cole, Edward N. and George W. Niepoth

INTERNAL COMBUSTION ENGINE AND METHOD OF OPERATION FOR EXHAUST EMISSION CONTROL. *(General Motors Corp., Detroit, Mich.) U. S. Pat. 3,824,788. 20p., July 23, 1974. 9 refs. (Appl. Dec. 6, 1972, 21 claims).*

An internal combustion engine and method of operation for exhaust emission control are described. Three modes of operation are provided. In the warm-up mode, air is injected at the combustion chamber exhaust ports to promote an oxidizing reaction in the exhaust gases. The exhaust gases are directed through the catalytic converter units to heat the converter units. In the converter mode, the exhaust gases are directed to the converter units and pass in a reducing atmosphere through a portion having a reducing catalyst. Air is injected into the exhaust gases leaving the reducing portion, and the gas is then passed to an oxidizing atmosphere through a portion having an oxidizing catalyst. In the reactor mode, air is injected at the combustion chamber exhaust ports to support an oxidizing reaction in the exhaust manifold reactors, and exhaust gas flow through the converter units is avoided to protect the catalyst. Unlike other systems, the converter units are protected during high temperature modes of operation while effective emission control is provided.

48728 **APTIC NO. 71386**

Coons, William R., Jr., James H. Colvert, and Gerald V. Nelson

HYDROCRACKING EFFLUENT COOLING PRIOR TO HYDRODESULFURIZATION. *(Texaco, Inc., New York) U. S. Pat. 3,825,485. 3p., July 23, 1974. 4 refs. (Appl. Sept. 7, 1972, 9 claims).*

A process for the catalytic hydrodesulfurization of heavy petroleum hydrocarbon oil is described. A residue containing petroleum fraction, 50% boiling above 1000 F, is hydrocracked and hydrodesulfurized. During the onstream period, the conversion level of material boiling above 1000 F is maintained substantially constant while the sulfur content of the hydrocracked effluent increases. The S content of a product fraction is maintained substantially constant by gradually increasing the hydrodesulfurization temperature. The effluent from the hydrocracking reaction is cooled by adding an aromatic-rich fraction, and the cooled mixture is passed to the desulfurization reaction. Conventional processes are able to reduce the S content of the oil, but the deactivation rates are as high as 2 F/day, which means that the unit must be shut down frequently either for regeneration or replacement of the catalyst. In this process the catalyst does not require frequent regeneration or replacement and the catalyst deactivation rate is low. (Author abstract modified)

48729 **APTIC NO. 71062**

Crow, George E.

AFTERBURNER FOR INTERNAL COMBUSTION ENGINE. *(Assignee not given.) U. S. Pat. 3,817,032. 4p., June 18, 1974. 10 refs. (Appl. May 5, 1972, 5 claims).*

An afterburner device for reducing unburned exhaust emissions from internal combustion engines is described. The device is installed between the engine exhaust manifold and the muffler. Exhaust gases from the engine are mixed with a stream of compressed air to ignite the unburned gases which then pass over heating grids in the afterburner. Remaining unburned gases pass through the heated grids and burn after self-ignition. The flow of air into the afterburner is controlled in relation to engine speed via a valve coupled to the accelerator rod on the carburetor. Provision is also made for cooling the afterburner via heat transfer to an outer sleeve.

48730 **APTIC NO. 71189**

Davis, Alan, William Spackman, and Peter H. Given

THE INFLUENCE OF THE PROPERTIES OF COALS ON THEIR CONVERSION INTO CLEAN FUELS. *Preprint, American Chemical Society, Washington, D. C., Div. of Petrolem Chemistry, 37p., 1974. 21 refs. (Presented at the American Chemical Society Meeting, Atlantic City, N. J., Sept. 1974.)*

The petrographic composition of coal and its influence on the conversion of coal into clean fuels are discussed. Coal is composed of a variety of materials called macerals which are of organic origin and some inorganic minerals which were washed into the coal-forming swamp sediment or which developed later within the peat or coal. Three main groups of macerals can be distinguished -- the vitrinite, exinite, and intertinite groups. The liquefaction of coal depends on the maceral and inorganic composition of the coal. Emission spectrograph determinations have been made of 13 inorganic elements in the liquid product and solid residue obtained from three volatile coals. It appears possible to define broad limits to both the rank and petrographic composition of coals which determine the suitability of coal for use in a liquefaction process. But presently the predictions cannot be made with a high degree of confidence. Many successful petrographic predictions of the behavior of coal in coke ovens are careful to stress precise conditions of carbonization. The best results should be obtained with high volatile coals; most subbituminous coals are less suitable, and lignites, although problematic and variable in response to hydrogenation, are still less suitable. Coals higher in rank than high volatile A should give much lower liquefaction yields and oils of higher viscosity. The measurement of the reflectance of vitrinite in oil has become a useful index of rank. Within reflectances of 0.49 to 1.01%, the liquefaction behavior depends on the content of reactive macerals. A figure is given characterizing coals by rank and type which provides a possible basis for the selection of coals for liquefaction. (Author abstract modified)

48731 **APTIC NO. 71492**

De La Fuente, Manuel Guadalajara

INTERNAL COMBUSTION ENGINE COMBUSTION CHAMBER DESIGN AND AIR/FUEL MIXTURE SUPPLY MEANS. *(Assignee not given.) U. S. Pat. 3,814,067. 14p., June 4, 1974. 11 refs. (Appl. Jan. 31, 1972, 1 claim).*

An internal combustion engine that incorporates a precombustion chamber with a principal combustion chamber to achieve more complete combustion and thus less unburnt exhaust emissions is described that overcomes prior-art drawbacks involving synchronization of the air-fuel mixtures to each combustion chamber by using a single dual carburetor for feeding both chambers. The principal combustion chamber communicates with the precombustion chamber via an aerodynamic section nozzle. The carburetor is adapted to provide individual qualitative control of separate air/fuel mixtures for each chamber. The excess-air zone provided by the engine design results in significant decreases in smoke and carbon monoxide emissions and improved fuel economy. Tetraethyl lead is transformed to lead monoxide or litharge which quickly settles to the ground, thus eliminating the hazard of suspended lead emissions.

48732 **APTIC NO. 70915**

Dennis, Richard and John E. Wilder

FACTORS IN THE COLLECTION OF FINE PARTICULATE MATTER WITH FABRIC FILTERS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 385-424. 8 refs. (Jan. 15-18, Paper 17.)*

Measurements of changes in size distributions and particle concentrations were made for typical shaken bag and pulse-jet fabric filter systems using test aerosols of talc or fly ash. Experiments with a mechanical shaken system employing cotton sateen bags for the filtration of fly ash showed that emissions decreased by as much as five orders of magnitude over the first 5 min of filtration. Average dust emissions increased significantly with shaking amplitude but were essentially unchanged with respect to frequency variations in shaking. Size distribution curves indicated that the dust discharging from the filters during the earlier phases of filtration was composed of relatively coarse material. In contrast to cotton fabrics, the 1-minute and 30-minute dust concentrations for dacron media were not appreciably different. In terms of weight collection efficiency, the average values for the dacron bags were about 99.8%. Whereas the differences in filter resistance indicated that fan power requirements would be only about 25% higher for cotton fabrics, choice of cotton would reduce particulate emissions by 1000 times. During fly ash filtration with a direct pulsed filter system, a six-fold range in emission levels was noted as compared to a 2.5 times change with damped pulse cleaning. All tests were made with wool or dacron felt tubes. Absolute outlet concentrations were about 1000 times greater than those for shaken cotton bags.

48733 **APTIC NO. 71274**

Deurbrouck, A. W. and P. S. Jacobsen

COAL CLEANING - STATE-OF-THE-ART. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 1-16. 14 refs. (Oct. 22-24.)*

The state-of-the-art of coal cleaning is reviewed in terms of removal of sulfur compounds, trace elements, and product moisture. Pyritic sulfur reduction can be achieved by the use of wet concentrating tables, the Humphreys coal-cleaning spiral, electrokinetic processes using thhe principles of electrophoresis, and froth flotation. Studies of two-stage froth flotation processes demonstrate pyritic sulfur reductions from 2.19% (original sample) to 0.42% (second-stage product). Certain trace elements can be selectively concentrated in particular specific gravity fractions of raw coal and may be readily removed by conventional coal cleaning prior to combustion. Innovations in fine-size coal-cleaning/dewatering equipment include: fine coal jigs, the Eis clarifier (a high-capacity sedimentation device), screen bowl Bird centrifuges, horizontal vacuum filters, and water-only cyclones.

48734 **APTIC NO. 71276**

Diehl, Erle K.

GAS GENERATOR UPDATE. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 30-36. (Oct. 22-24.)*

Coal gasification processes for the generation of gaseous fuel and the removal of sulfur and ash impurities from coal are reviewed. Three main types of reactor systems exist for coal gasification: fixed beds, fluidized beds, and entrained processes. Fixed-bed processes allow for high carbon conversion, though caking coals cannot normally be used unless they are pretreated. The fluidized-bed process is the most popular concept being developed and can tolerate a wide variety of coals. Some carbon is lost through entrainment of dust, and highly caking coals require some pretreatment. Entrained processes, where pulverized coal is suspended in the gasifying medium and the mixture passes concurrently through the gasifier along a high to low temperature profile, are capable of handling any type of coal without pretreatment. Carbon carryover is high, however, and recycle of uncoverted carbon is necessary. Other processes in the development stage include: a molten salt process; an Applied Technology Corporation process (ATGAS) involving the injection of coal into a molten-iron bath where steam and oxygen react with the carbon to produce hydrogen and carbon monoxide; and a process utilizing a nuclear heat source to supply energy for a solvent-type coal gasification. Commercial pipeline gas plants are estimated to be common by 1990.

48735 **APTIC NO. 71403**

Dillon, Thomas J. and Abe Warshaw

PRODUCTION OF LOW SULFUR COAL. *(Chemical Construction Corp., New York) U. S. Pat. 3,824,084. 4p., July 16, 1974. 3 refs. (Appl. Oct. 10, 1972, 12 claims).*

A process for converting coal containing pyritic sulfur to water-soluble ferrous and ferric sulfate is described. The coal is processed at elevated temperature and pressure with water and air. The resulting slurry is filtered to produce a low S coal which may be burned without producing sulfur dioxide emissions. The advantage of this process is that low S coal can be produced by inexpensive processing using readily available air and water. The system does not use a strong oxidizing agent to remove S. It manufactures its own depressive agent in the event that a final flotation purification step is required or desired. (Author abstract modified)

48736 **APTIC NO. 71285**

Dingo, Thomas T.

PERFORMANCE CHARACTERISTICS OF AN INDUSTRIAL SIZE DUAL-ALKALI SO2 REMOVAL SYSTEM. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 115-129. 3 refs. (Oct. 22-24.)*

A General Motors dual-alkali scrubbing process for the removal of sulfur dioxide from stack gases is described. The process involves the use of a dilute alkaline stream of sodium hydroxide to remove sulfur oxides from boiler gases and alkaline lime to regenerate the spent scrubbing liquor by precipitation of the absorbed sulfur to reform an hydroxide solution. Commercial demonstration of the system at a plant consuming 55,000 tons/yr of 2.0 to 3.0% sulfur coal with a steam generating capacity of 320,000 lb/hr indicates SO2 removal efficiencies of from 85-95% over a scrubber outlet pH range of 5.5-6.5. Cost estimates for the system are $12/ton of coal burned.

48737 **APTIC NO. 70466**

Dismukes, Edward

CONDITIONING OF FLY ASH WITH SULFAMIC ACID, AMMONIUM SULFATE, AND AMMONIUM BISULFATE. *Southern Research Inst., Birmingham, Ala., Environmental Protection Agency Contract 68-02-1303, Proj. 3134 XIII, Program Element 1AB012, Rept. EPA-650/2-74-114, ROAP 21ADJ-029, SORI-EAS-74-396, 58p., Oct. 1974. 45 refs.*

NTIS: PB- 238 922/AS

The effectiveness of sulfamic acid, ammonium sulfate, and ammonium bisulfate in regulating the electrical resistivity of fly ash in electric generating stations to ensure satisfactory collection of fly ash in electrostatic precipitators (ESPs) is summarized. The use of these agents in pilot and full scale ESPs is reviewed. The agents offer advantages over sulfur trioxide in the ease and freedom from hazard in handling, but ammonium sulfate is the only one competitive economically with SO3. The physical and chemical processes by which the lowering of resistivity occurs are not identified. The process of conditioning varies as the type of agent, the injection temperature, and the precipitator temperature. The same processes may increase the cohesiveness of fly ash from moderate to high sulfur coal. (Author conclusions modified)

48738 **APTIC NO. 70947**

Doi, K. and K. Azuma

AIR DEODORIZATION BY OZONE AND ACTIVATED CARBON. *(Ozon to kassei-tan ni yoru dasshu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):471, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 320.)*

To obtain basic information for ozone oxidation deodorization devices, the decomposition rate of O3 by activated charcoal and the removal rate of malodors from O3 and odorous mixtures by activated charcoal were investigated. The decomposition rate of O3 varied with O3 concentration, and empirical decomposition rate equations for three concentration ranges (90-20, 30-100, above 100 ppm) were obtained. The decomposition rate varied also with humidity, which increased with the increase in humidity at room temperature. The removal rate of methyl mercaptan and dimethyl sulfide by O3 and activated charcoal decreased with time. The reactivity of (CH3)S with O3 in the gaseous phase is higher than that of CH3SH; however, the oxidation reaction is retarded by the presence of activated charcoal. The removal rate of H2S deteriorated in the presence of O3 and the sulfur dioxide content in exhaust gas increased. Pretreatment of activated charcoal with sulfuric acid facilitated the removal of H2S, while potassium hydroxide decreased H2S removal but increased O3 decomposition rate.

48739 **APTIC NO. 70473**

Dorfman, Y. Y., A. M. Kunin, S. S. Gluzman, and N. I. Faingold

OPTIMIZATION OF SODIUM FORMATE SYNTHESIS FROM AMMONIA PLANT TAIL GASES. *(Optimizatsiya protessa polucheniya formiata natriya iz otkhodyashchikh gazov proizvodstva ammiaka). Sov. Chem. Ind. (English translation from Russian of: Khim. Prom.), 6(6):361-363, 1974. 6 refs.*

The results of a determination of the optimum process conditions for obtaining sodium formate from ammonia plant tail gases are described using statistical experimental design. The important factors which influence the process of sodium formate synthesis were studied to determine the most economical process conditions. The variables studied included number of trays, number of components in mixture, number of freed trays, weight fraction of vapor in starting mixture, vapor flux, amount of reflux, efficiency of a tray, and volatility coefficients. Preliminary investigations showed that the greatest productivity, 62 kg/cu m/hr, and the maximum yield of sodium formate occurred with alkali concentration of 100 g/l, molar ratio of carbon monoxide:sodium hydroxide equals 5:1, contact time 19 sec, and column level 0.53. The optimal conditions gave 56% conversion of CO. Experimental data agreed well with calculated data.

48740 **APTIC NO. 71298**

Doss, Joseph H.

ANTI-AIR POLLUTION SYSTEM FOR INTERNAL COMBUSTION ENGINE. *(Assignee not given.) U. S. Pat. 3,817,223. 6p., June 18, 1974. 11 refs. (Appl. Oct. 21, 1970, 8 claims).*

An internal combustion engine modification is described that provides for operation under excess oxygen, thus reducing exhaust pollutants. Each cylinder is provided with a negative angle curvature combustion chamber into which two separate fuel-air mixtures are introduced via two separate intake valves. One valve is located at the vertex of the combustion chamber adjacent the ignition means, and the second intake valve is located at the base of the combustion chamber where an exhaust valve is also located. The design permits full compression at all times, increases the thermal efficiency of the engine, and allows for a smooth flow of fuel into the combustion chamber vertex with a minimum of turbulence.

48741 **APTIC NO. 70916**

Draemel, Dean C.

THE STATE OF THE ART OF HIGH TEMPERATURE FILTRATION AND CURRENT TECHNOLOGY DEVELOPMENTS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine- Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 425-454. 17 refs. (Jan. 15-18, Paper 18.)*

The state of the art of high temperature (over 230 C) filtration technology is evaluated in terms of the capabilities of various filter materials. Particulate filters made of glass fibers are relatively low in cost compared to other high temperature materials, although they are limited in their ability to withstand mechanical abuse and tend to bleed under difficult filtration conditions. Mineral fibers (silica, aluminum silicate, and boron nitride) have higher theoretical operating temperatures than glass (1100 C versus 540 C), though some mineral fibers like those made of boron nitride are not effective in filtering submicron particulates. Carbon or graphite fibers suffer from poor long term time/temperature behavior which limits their use to temperatures of 320 C. Teflon fabrics are expensive and tend to bleed, though they are ideally suited for smaller applications in the 100-300 C range where chemical conditions are severe. Synthetic organic fibers like carbon fibers show poor time-temperature mechanical response. Metallic fabrics are well suited to cupola or blast furnace applications where limited space, high temperature surges, and possible sparks limit the application of more conventional filters. Granular bed filters are capable of operating up to 550 C without difficulty, though reliable filtration efficiencies cannot be predicted by theory, thus making their application uncertain. The major uses of sintered metal and ceramic filters in high temperature filtration applications appear to be in catalyst recovery operations.

48742 **APTIC NO. 71280**

Earl, Christopher B.

POWER PLANT STACK GAS CLEAN-UP VIA THE WELLMAN-LORD SO2 RECOVERY PROCESS. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 64-69. (Oct. 22-24.)*

Power plant stack gas treatment with the Wellman-Lord sulfur dioxide recovery process is reviewed. The process is based on a sodium sulfite/bisulfite system. Stack gas containing SO2 is contacted in an absorber by a solution of sodium sulfite. The solution absorbs the SO2, converting the sodium sulfite to sodium bisulfite. Clean gas is vented to the atmosphere from the absorber, and the sodium bisulfite solution is sent to an evaporator crystallizer unit for regeneration. The concentrated SO2 recovered can be fed to a conventional sulfuric acid plant, can be converted to elemental sulfur, or can be converted into liquid sulfur dioxide. The process finds its best application in treating gases containing 0.15-3.0% SO2 by volume. Sulfur dioxide removal efficiencies are over 90%. Estimated capital costs for a 500 MW plant using 3.5% sulfur coal are $30,000,000 for sulfuric acid by-product recovery and $33,000,000 for sulfur by-product recovery. Annual operating costs for each type of recovery are $10,900 and $13,050, respectively.

48743 **APTIC NO. 71286**

Ellison, W., S. D. Heden, and E. G. Kominek

SYSTEM RELIABILITY AND ENVIRONMENTAL IMPACT OF SO2 SCRUBBING PROCESSES. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 130-152. 15 refs. (Oct. 22-24.)*

Factors affecting the system reliability of various throw-away scrubbing processes for the removal of sulfur dioxide and particulates from stack gases are reviewed. Topics considered include: scrubbing liquids with high solids content, the conversion of absorbed sulfur oxides to a disposable solid, the curtailment of scrubbing-liquid purge, the retrofitting of scrubbers to existing emission sources, the chemistry of throw-away systems, caustic neutralization and double alkali regeneration in dual alkali systems, scrubbing liquid softening with soda ash or carbon dioxide, gas quenching, mist elimination, lime feeding facilities, clarifier thickeners, sludge dewatering, corrosion and erosion control, prevention of scrubbing liquid supersaturation, and the control of fly ash, SO2, and mist carryover emissions under applicable gas-flow turndown conditions. Various double-alkali systems are described.

48744 **APTIC NO. 70642**

Engels, L. H.

DUST TECHNOLOGY - METHODS, CAPACITY, EXPENDITURES. *(Entstaubungstechnik - Verfahren, Leistung, Aufwand). Text in German. Tech. Mitt., 67(11):478-484, 1974. (Presented at the Seminar on Dust Collection in Industrial and Commercial Plants, Haus der Technik, Essen, Germany, May 15, 1974.)*

Dust technology deals with dust particles whose sizes span a range of four decimal powers. The following basic processes are sources for dust emissions: crushing; classifying; sorting, mixing, and compacting processes; drying; combustion; roasting; melting; heat exchanging; transporting; storing; and surface treatment processes. A review of all available dust collection methods is given. Developments in the last few years have shown that the possibilities provided by centrifugal separators have not yet been fully exploited with regard to construction or application. Wet dust collectors are being used in nearly all industrial branches in a variety of designs. Dust filters come in round or rectangular casings with one or more chambers accommodating the filters in the form of tubular bags or envelopes. Synthetic or mineral filter materials have made dust filters applicable for dust collection in hot gases. Electrostatic precipitators come in horizontal or vertical design and operate dry or wet. The selection of the optimum dust collection method depends on the type of production process to be cleaned, on the mode of operation, the type, concentration and grain size distribution of dust particles to be separated, the temperature and humidity of the carrier gas and the desired and necessary collection efficiency, the available space and the possibilities of re-use of the separated dust. A graphical illustration of the investment costs for the various dust collection methods in dependence of the collection efficiency shows that equipment costs rise to various extents with increasing collection efficiency. The specific equipment costs change in dependence of the throughput; with increasing throughput the specific costs drop.

48745 **APTIC NO. 71270**

First, Melvin W., Walter Schilling, J. H. Govan, and Alan H. Quinby

CONTROL OF ODORS AND AEROSOLS FROM SPENT GRAIN DRYERS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 133-146. 11 refs. (March 18-19.)*

Results from pilot-plant and full-scale field tests involving the control of odors and aerosols in gases from spent grain dryers are presented. A combination of caustic scrubbing and oxidation by chlorine addition to the dryer off gas was more effective than absorption alone. Reductions in chromatographic peaks corresponding to odorant compounds of 95% were obtained in pilot studies involving a gas flow rate of 280 cfm, a dryer temperature of 230-236 F, and the addition of 5.7 ppm chlorine upstream of the absorber. The pH of the scrubbing solution was maintained at 11 by the addition of 20% sodium hydroxide to the last wet stage at a rate of 0.75 g/hr. Full-scale tests on a distillery dryer unit discharging 14,000 cfm at 200 F showed results exactly as predicted. Chlorine-induced corrosion of first stage Neva-clog screens fabricated of Monel metal was corrected by replacement with screens made of stainless steel alloys and titanium.

48746 **APTIC NO. 71066**

Frech, Kenneth J. and James J. Tazuma

ANTI-POLLUTION ANTI-KNOCK GASOLINE. *(Goodyear Tire and Rubber Co., Akron, Ohio) U. S. Pat. 3,822,119. 4p., July 2, 1974. 3 refs. (Appl. May 21, 1971, 9 claims).*

A no-lead, antiknock gasoline which reduces automobile exhaust emissions of lead salts, hydrocarbons, carbon monoxide, and nitrogen oxides in comparison with leaded gases or nonleaded gases of high aromatic content is described. The antipollution fuel consists of a typical gasoline hydrocarbon base stock, at least one alcohol containing from four to eight carbons, and water. The amount of alcohol ranges from about 5-40 volume%, and the amount of water ranges from about 0.1-25 vol%. Suitable alcohols include: methyl, ethyl, isopropyl, tertiary butyl, and tertiary amyl alcohol. The process can be employed for gasolines which are now commercially available.

48747 **APTIC NO. 71306**

Fukunaga, K. and T. Osaki

MANUFACTURING METHOD FOR ACTIVATED CARBON FOR DESULFURIZATION OF STACK GAS. *(Haien datsuryu yo kasseitan no seizo hoho). Text in Japanese. (Kurare Chemical Co., Ltd., Okayama (Japan)) Japan. Pat. Sho 49-45157. 2p., Dec. 2, 1974. 1 ref. (Appl. July 31, 1970, 1 claim).*

Manufacturing of active carbon, suitable for oxidizing sulfurous acid gas to sulfuric acid gas, is described. By using mineral acids to remove alkali metals and alkaline earth metals from plant or mineral source organic materials during the manufacturing process, active carbon, which is highly reactive to sulfur dioxide adsorption, is obtained. Treatment with mineral acids is effected prior to the activation process. After treatment, SO2 adsorption rates of 25-30% on active carbon were obtained. Without treatment, SO2 adsorption rates ranged from 14-20%.

48748 **APTIC NO. 70600**

Fukuyama, J., H. Itoh, and A. Honda

THE REMOVAL OF MALODOROUS SULFUR-CONTAINING GASES Y ACTIVATED SLUDGE. *(Io-kei akushu gasu no kassei odei ni yoru jokyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):470, Nov. 1974. (Presented at the 15th National* solution absorbs the SO2, converting the sodium sulfite to sodium bisulfite. Clean gas is vented to the atmosphere from the absorber, and the sodium bisulfite solution is sent to an evaporator crystallizer unit for regeneration. The concentrated SO2 recovered can be fed to a conventional sulfuric acid plant, can be converted to elemental sulfur, or can be converted into liquid sulfur dioxide. The process finds its best application in treating gases containing 0.15-3.0% SO2 by volume. Sulfur dioxide removal efficiencies are over 90%. Estimated capital costs for a 500 MW plant using 3.5% sulfur coal are $30,000,000 for sulfuric acid by-product recovery and $33,000,000 for sulfur by-product recovery. Annual operating costs for each type of recovery are $10,900 and $13,050, respectively.

48743 **APTIC NO. 71286**

Ellison, W., S. D. Heden, and E. G. Kominek

SYSTEM RELIABILITY AND ENVIRONMENTAL IMPACT OF SO2 SCRUBBING PROCESSES. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 130-152. 15 refs. (Oct. 22-24.)*

Factors affecting the system reliability of various throw-away scrubbing processes for the removal of sulfur dioxide and particulates from stack gases are reviewed. Topics considered include: scrubbing liquids with high solids content, the conversion of absorbed sulfur oxides to a disposable solid, the curtailment of scrubbing-liquid purge, the retrofitting of scrubbers to existing emission sources, the chemistry of throw-away systems, caustic neutralization and double alkali regeneration in dual alkali systems, scrubbing liquid softening with soda ash or carbon dioxide, gas quenching, mist elimination, lime feeding facilities, clarifier thickeners, sludge dewatering, corrosion and erosion control, prevention of scrubbing liquid supersaturation, and the control of fly ash, SO2, and mist carryover emissions under applicable gas-flow turndown conditions. Various double-alkali systems are described.

48744 **APTIC NO. 70642**

Engels, L. H.

DUST TECHNOLOGY - METHODS, CAPACITY, EXPENDITURES. *(Entstaubungstechnik - Verfahren, Leistung, Aufwand). Text in German. Tech. Mitt., 67(11):478-484, 1974. (Presented at the Seminar on Dust Collection in Industrial and Commercial Plants, Haus der Technik, Essen, Germany, May 15, 1974.)*

Dust technology deals with dust particles whose sizes span a range of four decimal powers. The following basic processes are sources for dust emissions: crushing; classifying; sorting, mixing, and compacting processes; drying; combustion; roasting; melting; heat exchanging; transporting; storing; and surface treatment processes. A review of all available dust collection methods is given. Developments in the last few years have shown that the possibilities provided by centrifugal separators have not yet been fully exploited with regard to construction or application. Wet dust collectors are being used in nearly all industrial branches in a variety of designs. Dust filters come in round or rectangular casings with one or more chambers accommodating the filters in the form of tubular bags or envelopes. Synthetic or mineral filter materials have made dust filters applicable for dust collection in hot gases. Electrostatic precipitators come in horizontal or vertical design and operate dry or wet. The selection of the optimum dust collection method depends on the type of production process to be cleaned, on the mode of operation, the type, concentration and grain size distribution of dust particles to be separated, the temperature and humidity of the carrier gas and the desired and necessary collection efficiency, the available space and the possibilities of re-use of the separated dust. A graphical illustration of the investment costs for the various dust collection methods in dependence of the collection efficiency shows that equipment costs rise to various extents with increasing collection efficiency. The specific equipment costs change in dependence of the throughput; with increasing throughput the specific costs drop.

48745 **APTIC NO. 71270**

First, Melvin W., Walter Schilling, J. H. Govan, and Alan H. Quinby

CONTROL OF ODORS AND AEROSOLS FROM SPENT GRAIN DRYERS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 133-146. 11 refs. (March 18-19.)*

Results from pilot-plant and full-scale field tests involving the control of odors and aerosols in gases from spent grain dryers are presented. A combination of caustic scrubbing and oxidation by chlorine addition to the dryer off gas was more effective than absorption alone. Reductions in chromatographic peaks corresponding to odorant compounds of 95% were obtained in pilot studies involving a gas flow rate of 280 cfm, a dryer temperature of 230-236 F, and the addition of 5.7 ppm chlorine upstream of the absorber. The pH of the scrubbing solution was maintained at 11 by the addition of 20% sodium hydroxide to the last wet stage at a rate of 0.75 g/hr. Full-scale tests on a distillery dryer unit discharging 14,000 cfm at 200 F showed results exactly as predicted. Chlorine-induced corrosion of first stage Neva-clog screens fabricated of Monel metal was corrected by replacement with screens made of stainless steel alloys and titanium.

48746 **APTIC NO. 71066**

Frech, Kenneth J. and James J. Tazuma

ANTI-POLLUTION ANTI-KNOCK GASOLINE. *(Goodyear Tire and Rubber Co., Akron, Ohio) U. S. Pat. 3,822,119. 4p., July 2, 1974. 3 refs. (Appl. May 21, 1971, 9 claims).*

A no-lead, antiknock gasoline which reduces automobile exhaust emissions of lead salts, hydrocarbons, carbon monoxide, and nitrogen oxides in comparison with leaded gases or nonleaded gases of high aromatic content is described. The antipollution fuel consists of a typical gasoline hydrocarbon base stock, at least one alcohol containing from four to eight carbons, and water. The amount of alcohol ranges from about 5-40 volume%, and the amount of water ranges from about 0.1-25 vol%. Suitable alcohols include: methyl, ethyl, isopropyl, tertiary butyl, and tertiary amyl alcohol. The process can be employed for gasolines which are now commercially available.

48747 **APTIC NO. 71306**

Fukunaga, K. and T. Osaki

MANUFACTURING METHOD FOR ACTIVATED CARBON FOR DESULFURIZATION OF STACK GAS. *(Haien datsuryu yo kasseitan no seizo hoho). Text in Japanese. (Kurare Chemical Co., Ltd., Okayama (Japan)) Japan. Pat. Sho 49-45157. 2p., Dec. 2, 1974. 1 ref. (Appl. July 31, 1970, 1 claim).*

Manufacturing of active carbon, suitable for oxidizing sulfurous acid gas to sulfuric acid gas, is described. By using mineral acids to remove alkali metals and alkaline earth metals from plant or mineral source organic materials during the manufacturing process, active carbon, which is highly reactive to sulfur dioxide adsorption, is obtained. Treatment with mineral acids is effected prior to the activation process. After treatment, SO2 adsorption rates of 25-30% on active carbon were obtained. Without treatment, SO2 adsorption rates ranged from 14-20%.

48748 **APTIC NO. 70600**

Fukuyama, J., H. Itoh, and A. Honda

THE REMOVAL OF MALODOROUS SULFUR-CONTAINING GASES BY ACTIVATED SLUDGE. *(Io-kei akushu gasu no kassei odei ni yoru jokyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):470, Nov. 1974. (Presented at the 15th National*

Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 319.)

An experimental deodorization device consisting of two aeration tanks containing activated sludge was developed, and its deodorization capability for sulfur malodors was tested. The removal rates of hydrogen sulfide and methyl sulfide were determined by measuring concentrations before and after the treatment using flame photometric gas chromatography. The removal rate by naturalized sludge was higher than that of unnaturalized sludge. The removal rates by activated sludge and distilled water were compared and the latter was extremely inferior. The effect of adding glucose to an aeration tank with an odor removal rate of above 99% resulted in an immediate deterioration of efficiency. The relationship between load and treatment efficiency was investigated, which indicated the removal rate of above 99.5% was achieved with load less than 13-15 mg/g/day for H_2S and 10 mg/g/day for $(CH_3)_2S$.

48749 **APTIC NO. 70349**

Fukuzawa, Hisashi and Yoshimi Ishihara

CATALYTIC REDUCTION OF NITROGEN OXIDES Y AMMONIA--THE ACTIVITY OF METAL OXIDE CATALYSTS. *(Anmonia ni yoru sanka chisso no sesshoku kangen--kinzoku sankabutsu shokubai no katsusei). Text in Japanese. Preprint, Japan Chemical Society, Sendai, p. 654, 1974. (Presented at the Japan Chemical Society, Fall Meeting, 31st, Sendai, Japan, Oct. 2-5, 1974, Paper 2Q16.)*

The effectiveness of various metal catalysts was studied for contact reduction of nitrogen oxides by ammonia. When sulfur dioxide was not present, reduction activity was high for copper, iron, chromium, cobalt, and vanadium systems. A removal rate of over 70% for nitric oxide occurred, with maximum activity occurring from 100-200 C. In the presence of SO_2, some systems (Cu, Cr, V) exhibited higher NO removal rates (80-90% at 250-400 C), while other systems (Fe, Co-Cr) showed decreased activity (55% for Fe at 300 C, no activity for Co-Cr).

48750 **APTIC NO. 71345**

Fusamura, N., T. Nagoya, S. Oya, T. Takada, S. Furuta, and T. Fujii

SURFACE COVERED MELTING OF LEADED BRONZES FOR SUPPRESSING METAL FUMES. *(Namari iri jitsuyo dogokin ni okeru fuyyume yokusei yokai ni tsuite.) Text in Japanese. Imono (Foundry), 46(8): 102, Aug. 1974.*

The suppression of metal fume generation from leaded bronzes by calcium carbonate and clay was studied. A leaded bronze (5% Pb) was placed in a carbon crucible and heated to 1200 C. The generated metal fumes were trapped and quantitized by colorimetry or electrolysis. When the bronze surface was covered with calcium carbonate and calcium carbonate was covered with a clay in the ratio five to one for a total layer thickness of 23.5 mm, the generated lead fume was 9 and 3 micrograms/min at 1200 C and 1100 C, respectively. When the bronze itself was heated, the lead fume was 50 and 20 micrograms/min at 1200 C and 1100 C, respectively. A similar result was also observed for zinc fumes.

48751 **APTIC NO. 70986**

Garcea, Giampaolo

DEVICE FOR THE POST-COMBUSTION OF THE UNBURNT SUBSTANCES IN THE EXHAUST GASES OF THE INTERNAL COMBUSTION ENGINE OF A MOTOR VEHICLE. *(Alfa Romeo S.p.A., Milan (Italy)) U. S. Pat. 3,820,328. 9p., June 28, 1974. 6 refs. (Appl. Sept. 22, 1971, 10 claims).*

A post-combustion system for the reduction of unburned emissions from internal combustion engines is described that provides for the location of a shut-off valve in a terminal portion of the exhaust pipe where temperatures are sufficiently low to permit less costly construction and more reliable operation of the valve as compared to prior-art designs. During low-power conditions, exhaust is entirely fed to the post-combustion chamber which is located near the engine for maximum heat transfer. At high-power conditions, the exhaust gases are bypassed around the post- combustion chamber via a shut-off valve located in the terminal portion of the exhaust system.

48752 **APTIC NO. 71465**

Gimadeyev, M. M. and F. F. Dautov

ON THE EFFICIENCY OF AIR POLLUTION CONTROL MEASURES AT THE KAZAN ORGANIC SYNTHESIS PLANT. *(Ob effektivnosti meropriyatiy po ozdorovleniyu atmosfernogo vozdukha v rayone kazanskogo zavoda organicheskogo sinteza). Text in Russian. Gigiena i Sanit., no. 9:88-89, 1974.*

Air pollution control measures taken at the Kazan organic synthesis plant, and their effect on the air quality within and beyond the plant premises are described. The plant, in which high-density polyethylene, ethylene oxide, phenol, and acetone are manufactured, is responsible for hydrocarbon, ethylene oxide, acetone, phenol, and isopropylbenzene emissions due to leaks and vent air release. The air pollution control measures taken recently, such as increasing the height of stacks, improved sealing of the equipment (including pumps and compressors), the installation of separators for organic vapors, and the incineration of tail gases from the ethylene oxide production unit, have considerably reduced emissions and air pollutant levels in and around the chemical plant. The incidence of pollutant concentrations exceeding the respective maximum allowable values has decreased sharply. The utilization of combustible waste gases and vapors in a thermal power plant on the plant premises, instead of burning in high torches, is being considered.

48753 **APTIC NO. 71116**

Grantham, Le Roy F.

MUFFLER DEVICE. *(Rockwell International Corp.) U. S. Pat. 3,817,715. 6p., June 18, 1974. 4 refs. (Appl. Feb. 20, 1970, 11 claims).*

A muffler device that contains an absorbent salt for the removal of internal combustion engine exhaust impurities, particularly nitrogen oxides and particulates such as lead, is described. The device overcomes the limitations of high cost, thermocyclic fracture, and poisoning associated with catalytic afterburners. The absorbent salt, which is a mixture of alkali metal carbonates, is solid at room temperature and molten at the operating temperature of the internal combustion engine. Exhaust gases passing from the inlet to the outlet of the muffler housing come in contact with the molten salt and are absorbed. The molten salt mixture preferably contains at least 50 wt% of the active absorbent. A eutectic composition consisting of 45 plus or minus 5 mole% lithium carbonate, 30 plus or minus 5 mole% sodium carbonate, and 25 plus or minus 5 mole% potassium carbonate with a melting point of about 395 C is particularly suitable. (Author summary modified)

48754 **APTIC NO. 70907**

Green, George P. and W. S. Landers

OPERATING EXPERIENCE WITH GAS CONDITIONED ELECTROSTATIC PRECIPITATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 169-188. (Jan. 15-18, Paper 8.)*

The effect of flue gas conditioning on the fly ash collection efficiency of eight electrostatic precipitators installed on pulverized coal burning units of the Public Service Company of Colorado is reported. The addition of 15-20 ppm of sulfur trioxide directly to the flue gas before the electrostatic precipitator increased collection efficiencies from a range of 37.5-94.0% for the eight units prior to gas conditioning to a range of 51.4-96.2%. The low efficiencies prior to SO3 treatment were due to the high resistivity of the untreated fly ash (10 to the 13 ohm/cm) which in turn was due to the fact that the plant burns low sulfur western coal. Gas conditioning did not compensate for design deficiencies other than the resistivity problem.

48755 **APTIC NO. 70422**

Habib, Yousuf and W. F. Bischoff

FW-BF DRY ADSORPTION SYSTEM FOR FLUE GAS CLEAN UP - A STATUS REPORT. *Preprint, American Inst. of Chemical Engineers, New York, 31p., 1974. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 67th, Washington, D. C., Dec. 1-5, 1974, Paper 85d.)*

The FW-BF Dry Adsorption System for flue gas desulfurization is described including the adsorption, regeneration, and reduction of flue gas sulfur dioxide to elemental sulfur. In pilot plant studies sulfur oxides removal of up to 95% and nitrogen oxides removal in the 40-65% range were recorded. The adsorber was effective in reducing the dust content of the flue gas, and a 90-95% removal of particulate matter entering the system after a precipitator was achieved. Large scale demonstration units and testing programs are underway. Advantages of the system include dry, regenerable, and economic plot requirements, absence of scaling, plugging, stack reheat, sludge disposal, and slurries handling. (Author summary modified)

48756 **APTIC NO. 70482**

Hamersma, J. W., M. L. Kraft, W. P. Kendrick, and R. A. Meyers

MEYERS PROCESS CUTS OUT 80% SULFUR. *Coal Mining Processing, 1974:36-39, Aug. 1974. (Presented at the American Chemical Society, National Meeting, 167th, Los Angeles, Calif., 1974.)*

A process for removing up to 80% of the sulfur from coal through chemical leaching of pyritic sulfur with aqueous ferric sulfate solutions at 90-130 C is described. The ferric sulfate leaching agent is regenerated at similar temperatures using air or oxygen, and elemental sulfur and iron sulfates are removed as reaction products. The process removes the pyritic sulfur content of coal without reaction with organic sulfur in the coal matrix. A pilot plant design effort, preparatory to pilot plant construction and operation, is nearly complete. Experimental results are presented for both Meyers leaching process and float sink testing (physical cleaning) of 19 U. S. coals ranging from sub-bituminous A through low volatile bituminous in rank, in total sulfur from 1.0 to 6.4%, and in pyritic sulfur from 0.3 to 5.2% w/w (dry, moisture-free basis). The Meyers Process, at its current state of development, removed 83-98% of the pyritic sulfur content of the 19 coals studied, resulting in total sulfur reductions of 40-82%. Nine of the coals were reduced in sulfur content to the 0.6-0.9% levels generally consistent with Federal and state standards. Two coals were reduced below 1.0% sulfur by physical cleaning.

48757 **APTIC NO. 71292**

Hansford, Rowland C.

EXHAUST GAS CONVERSION PROCESS AND CATALYST. *(Union Oil Co. of California, Los Angeles) U. S. Pat. 3,816,401. 3p., June 11, 1974. 7 refs. (Appl. May 25, 1972, 2 claims).*

A catalyst for the oxidation of carbon monoxide and hydrocarbons and the reduction of nitrogen oxides in internal combustion engine ehxaust gases is described that, unlike prior art catalysts, is exceptionally selective for the conversion of NOx to elemental nitrogen rather than to ammonia. Since ammonia formed during the reduction stage of a catalytic conversion process can be oxidized back to nitric oxide in the subsequent oxidation stage, the present invention offers the advantage of avoiding secondary NO formation. It also may be used in single stage converters if complete conversion of CO is not required. The active component of the catalyst is an intimately admixed, calcined composition of copper oxide and iron oxide, with the weight ratio of copper to iron being between 6/4 and 4/6 (copper oxide/iron oxide). The composite is calcined at a temperature of between 1600 and 2000 F for a sufficient time to form a spinel phase.

48758 **APTIC NO. 70889**

Haslett, R. A.

A TECHNIQUE FOR ENDURANCE TESTING OF OXIDATION CATALYTIC REACTORS. *Preprint, Society of Automotive Engineers, New York, 12p., 1974. 1 ref. (Presented at the Society of Automotive Engineers Automotive Engineering Congress, Detroit, Mich., Feb. 25-March 1, 1974, Paper 740246.)*

A technique for endurance testing of oxidation catalytic reactors is described based on experiments comparing the effects of two methods of engine test-bed aging (vehicle simulation test bed and step cycle test bed) with vehicle endurance testing. The test-bed engines caused a higher rate of catalyst deterioration than the vehicle test, with major differences in exhaust carbon monoxide levels being observed (0.5-1.0% for the vehicle and 2-5% for the test beds). The rate of catalyst deterioration in these tests is primarily a function of engine CO level. The technique for accelerated catalyst aging derived from the tests involves aging the reactor on a test bed for three 100-hour periods. At the 0, 100, 200, and 300-hour stages, the reactor is removed for the test bed and transferred to another engine for detailed tests of catalyst performance. A 1975 constant volume sampling test on a vehicle is also included in each set of experiments.

48759 **APTIC NO. 71112**

Hattori, Hisao

TECHNIQUES OF ATMOSPHERIC POLLUTION PREVENTION. *(Taiki osen boshi gijutsu). Text in Japanese. Sangyo Kogai Boshi Gijutsu (Ind. Pollut. Control Tech.), 1974:29-32, June 1974. 2 refs.*

Countermeasures against atmospheric pollution by the exhaust gases from automobiles are discussed including techniques to remove sulfur and eliminate nitrogen oxides. In terms of the improvement of engine design, efforts are being made on the layer supply of air to the engines, C.V.C.C. engines (which make use of both the preliminary heating chamber and the direct injection of fuels), and the supercharging of air. For the treatment of exhaust gases, studies are being made on the use of catalysts. It was so far found that copper oxide, chromic oxide, and silver oxide are effective as oxidizing catalysts. Studies are being made at laboratory scale with the illumination of gaseous mixtures on the photochemical smog caused by the exhaust gases from automobiles. It was so far found that the formation of acrolein, which is the most troublesome of all the oxidants, depends on the content of diolefins. Smokes are now industrially desulfurized. For example, all the smokes from a 200,000 kW boiler in the Nagoya Electric Power Plant are being treated by the wet method. The biggest effort against nitrogen oxides will be made in the latter half of the 1970s. The reduction of NOx is being studied with the use of catalysts composed of the oxides of cobalt, iron, copper, vanadium, manganese, molybdenum, tungsten, and chromium. The absorption of NOx by various solutions is also being studied.

48760 **APTIC NO. 70987**

Hausberg, Gerhard and Karl-Rudolf Hegemann

APPARATUS FOR SCRUBBING WASTE GASES. *(Assignee not given.) U. S. Pat. 3,820,307. 5p., June 28, 1974. 6 refs. (Appl. Oct. 12, 1971, 10 claims).*

A scrubber apparatus for the cleaning of large quantities of highly dust-laden waste gases, such as those from a Bessemer converter, is described that allows for more compact construction than prior-art scrubbing devices without sacrificing efficiency. Waste gases from the converter are conducted downward through a wash tower containing several spray heads above a parallel array of constricted nozzles forming annular gaps to accelerate the flow of wetted gas from an upper to a lower compartment. Just below a partition separating the two compartments, a lateral outlet for the expanding gases lies above the level of the lower nozzle ends such that the gas flow undergoes a change of direction with the resulting separation of entrained droplets from the gas. The flow then passes downward through an adjoining water separator in the form of a vertical cylinder, with a central deflector being separated from the peripheral wall by an annular clearance containing vanes for imparting a swirling motion to the gas stream. (Author abstract modified)

48761 **APTIC NO. 70702**

Hayashida, S., M. Wasamoto, and N. Fukami

SECONDARY AIR INJECTION DEVICE FOR MULTI-PISTON ROTARY ENGINE. *(Tarotari pisuton enjin no niji kuki chunyu sochi). Text in Japanese. (Toyo Kogyo Co., Ltd., Hiroshima (Japan)) Japan. Pat. Sho 49-43742. 3p., Nov. 22, 1974. (Appl. March 31, 1971, 1 claim).*

For the reduction in toxic components such as hydrocarbons and carbon monoxide in rotary engine exhaust gases, a common secondary air injection system with openings to each combustion chamber at positions near the exhaust port is placed in the side housing. The amount of air injected is controlled automatically by the pressure difference in the exhaust port due to the phase difference of rotors attached to a common eccentric rod with a 180 deg phase difference. Concentrations of fuel and incompletely combusted components are lower at the leading side of compression chamber and higher at the following side. In this system, the amount of air injected is automatically increased with rotation of rotor, injecting more air at the following side for efficient combustion.

48762 **APTIC NO. 71195**

Hegedus, L. Louis

TEMPERATURE EXCURSIONS IN CATALYTIC MONOLITHS. *General Motors Corp., Warren, Mich., Physical Chemistry Dept., GMR-1712, PCP-30, 33p., Oct. 17, 1974. 9 refs. (Presented at the American Inst. of Chemical Engineers, Annual Meeting, 67th, Washington, D. C., Dec. 1-5, 1974.)*

The application of monolithic catalysts to automotive emission control has frequently been complicated by unexplained thermal degradation phenomena. Experimental and theoretical studies aimed at the understanding of these overtemperature phenomena are described. Theoretical considerations indicated that under certain operating conditions the steady state solid catalyst temperature can exceed the adiabatic reaction temperature and that the catalyst overtemperature can be influenced by the nature of the reactive species and by the geometry of the catalyst. These predictions were verified by experiments in a novel tubular reactor. (Author abstract)

48763 **APTIC NO. 70978**

Heitland, Herbert

CONVERTER FOR CATALYTIC EXHAUST GAS CLEANING. *(Volkswagenwerk Aktiengesellschaft, Wolfsburg (West Germany)) U. S. Pat. 3,814,589. 3p., June 4, 1974. 4 refs. (Appl. June 11, 1971, 5 claims).*

A catalytic converter for automobile exhaust emission control is described that utilizes a simplified bypass arrangement which is not subjected to mechanical failures associated with similar prior-art arrangements. The converter housing is made from a material having a high positive coefficient of expansion, while the catalyst is made of a material having a low coefficient of expansion. Moreover, the catalyst is secured in a fixed manner to the housing only at a downstream region of the latter. Thus, the opening or closing of a bypass located in the upstream portion of the housing is solely controlled by the movement of the housing relative to the catalyst. The bypass is closed at low temperatures, thus forcing the exhaust gas to pass through the catalyst. At high temperatures, expansion causes the bypass to open, thus protecting the catalyst from thermal damage.

48764 **APTIC NO. 70917**

Hesketh, Howard E.

ATOMIZATION AND CLOUD BEHAVIOR IN WET SCRUBBERS. *United States- USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 455-478. 9 refs. (Jan. 15-18, Paper 19.)*

The methods under which cloud-type and drop-type atomization are produced in two-fluid atomizing scrubbers are theoretically examined in relation to fine particle capture. Equations are developed to relate collection efficiency for particles less than 5 micron in diameter with pressure drop for non-plugging venturi scrubbers at gas velocities of 200 ft/sec. Preliminary data imply that collection efficiency is a function of pressure drop which needs only to be properly expressed as a function of gas velocity. The use of wetting agents or surfactants appears practical for improving particle collection efficiency by making the atomization occur more easily and also by enhancing particle wettability. The incorporation of diffusiophoresis, Stephan flow, and thermophoresis along with the data derived on atomization offer the possibility of making atomizing scrubbers more economical for fine particle control.

48765 **APTIC NO. 71342**

Hiramatsu, Makoto

COMBUSTION APPARATUS FOR WASTE GASES. *(Haigasu nensho sochi)). Text in Japanese. (Kurimoto Tekkosho KK (Kurimoto Steelworks, Ltd.) Osaka (Japan)) Japan. Pat. Sho 49-44454. 5p., Nov. 28, 1974. (Appl. July 23, 1970, 3 claims).*

A device is described which regulates amounts of air to be mixed with exhaust gases for incineration treatment of stack gases. Electrode poles are arranged in stepwise fashion in respective compartments at the exhaust end of the waste gas carrier tube, which is immersed in water in a sealed compartment. Another electrode pole is placed in the water, perpendicular to these electrode poles, but not touching them. Exhaust gas pressure changes the number of electrodes involved in electrical conductivity through water, and changes in electrical circuitry operate electomagnetic valves and pressure reduction valves. The mixture ratio of waste gas and air can be automatically controlled. Wave-dampening mesh plates are attached at the bottom of the exhaust tubes, to prevent formation of semi-permeable membranes near the electrodes.

48766 **APTIC NO. 71418**

Hiwatari, Shuzo and Yataro Takahashi

EXHAUST GAS CLEANING METHOD. *(Haigasu no seijo hoho). Text in Japanese. (Assignee not given.) Japan. Pat. Sho-49-48069. 1p., Dec. 19, 1974. (Appl. Feb. 12, 1971, 1 claim).*

This invention for the removal of harmful gases from exhaust gas features the use of latex solution and acetic acid solution. A cylindrical spraying chamber with 4 spray nozzles is equipped at the flat portion of a boiler stack, and latex solution (5-fold diluted) and glacial acetic acid solution (15-fold diluted) are sprayed together. The adhesive rubber particles solidified by acetic acid solution adsorb harmful substances from waste gas. Large networks are formed from the resulting particles and adsorption of harmful practices in waste gas is completed through further contact with waste gas.

48767 **APTIC NO. 71402**

Holman, Harry Francis

METHOD OF ANCHORING FINELY GRANULATED DUST MATERIAL FROM PURIFYING PLANTS FOR METALLURGIC WASTE GASES IN ORDER TO RENDER THE DUST DISPOSABLE OR UTILIZABLE. *(Hunfos Fabrikker, Vennesla (Norway)) U. S. Pat. 3,824,091. 3p., July 16, 1974. 11 refs. (Appl. July 19, 1972, 4 claims).*

A method of anchoring silicon dioxide dust particles from metallurgical processes into organic material for useful applications of disposal is described. The dust is secured by a binder of sulfite leach into sludge, bark, municipal garbage, or peat. The final material retains its structure under varying climatic conditions. It has a moisture content of 40-50% and can be used as a base for plant cultivation. An unlimited amount of dust can be used which makes this process superior to similar processes.

48768 **APTIC NO. 71229**

Holt, E. L.

AUTOMOTIVE CATALYSTS EFFECTS ON EMISSIONS AND FUEL ECONOMY. *Preprint, American Inst. of Chemical Engineers, New York, 7p., 1974. 15 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 67th, Washington, D. C., Dec. 2, 1974.)*

The effects oxidation catalysts have on fuel economy and on gaseous and particulate emissions, with emphasis on sulfate formation, were tested on experimental cars with various oxidation catalysts which met thy 1977 standards for carbon monoxide and hydrocarbon emissions. Catalyst durability under long-term use with various fuels and lube oils was also studied. Addition of oxidation catalysts to most 1975 U. S. automobiles resulted in a substantial fuel economy benefit, due to returning of engines for better efficiency, while simultaneously meeting interim standards for CO and HC. The stringent 1977 standards for these pollutants should be achievable without any significant fuel economy loss for 1975 levels. However, meeting even the 1977 interim nitrogen oxide standard will likely cause a fuel economy loss. Oxidation catalysts also provided the advantage of reducing unregulated emissions such as aldehydes and polynuclear aromatics to very low levels and of lowering the specific photochemical reactivity of those hydrocarbons which were emitted. However, the catalysts increased emissions of sulfuric acid through oxidation of sulfur dioxide to sulfur trioxide. The extent of such emissions varied widely due to storage properties of the catalyst support. Because of this and other reasons, the health implications of SO2 oxidation were not clear. Catalyst durability appeared to be unaffected by traces of lead up to 0.1 g/gal and by the use of ash-and phosphorus-containing lube oils, at least in the case of noble metal monoliths. These catalysts also were capable of withstanding brief exposure to fully leaded fuel without any significant permanent activity losses. Reports that these catalysts can operate continuously on certain types of leaded fuels may be based on the inability of such formulations to carry the Pb to the catalyst and on the resulting trapping of Pb in the engine and exhaust system. (Author conclusions modified)

48769 **APTIC NO. 70991**

Huba, Francis and Irving Malkin

CATALYST FOR OXIDATION OF HYDROCARBONS AND CARBON MONOXIDE. *(Diamond Shamrock Corp., Cleveland, Ohio) U. S. Pat. 3,819,535. 11p., June 25, 1974. 7 refs. (Appl. April 13, 1972, 7 claims).*

A catalyst for the oxidation of hydrocarbons and carbon monoxide in exhaust streams from internal combustion engines is described which maintains high activity after prolonged use, resists thermal shrinkage, and has a low ignition temperature in comparison with prior-art catalysts. The catalyst additionally removes nitrogen oxide from oxygen lean exhaust mixtures. The catalyst is prepared by depositing a layer of copper oxide and then cerium oxide on an alumina support which has been stabilized against shrinkage. When a preformed alumina support is used, the support can be stabilized against shrinkage by soaking the support in a solution of a barium salt and heat treating prior to deposition of the copper oxide layer. An alumina support which is stable against shrinkage can be prepared by treating alumina powder with a solution of chromic acid and a barium or magnesium salt to form spheres which are then dried and heat treated. (Author abstract modified)

48770 **APTIC NO. 71471**

Ikeda, M., T. Mizuhatake, and I. Maeda

EFFECT OF COMBUSTION CONDITIONS ON NITROGEN OXIDES FORMATION IN FURNACES. *(Yokairo yori hassei suru chisso sankabutsu oyobi nensho joken no eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):416, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 267.)*

Nitrogen oxides prevention by low oxygen combustion conducted at A plant was reported. The melting furnace subjected to the study treated 300 tons/day of raw materials using 1500 l/hr A heavy oil which contained 0.9% sulfur. About 45% of total nitrogen dioxide was emitted during the melting period while 36% was emitted during the feeding period. Total NOx contained about 51% NO2 which resulted from thermal nitric oxide and secondary oxygen. Nitrogen oxides concentrations were reduced 14% and 33% when secondary O2 was cut 10% and 20%, respectively. The total flue gas emission was also reduced 7% and 20%, respectively. The NOx concentration could be reduced as much as 83% during the melting period by cutting the secondary oxygen by 23.1%, which was the limit of O2 reduction from normal conditions.

48771 **APTIC NO. 71022**

Inoue, K., K. Yoshizumi, Y. Iida, Y. Endo, M. Udagawa, and T. Watanabe

EFFECT OF LEAD FREE GASOLINE ON CATALYTIC CONVERTER AND ENGINE. *(Muen gasorin shiyo ni yoru shokubai-shiki joka sochi no taikyu-sei to enjin eno eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):477, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th Chiba, Japan, Nov. 6-8, 1974, Paper 325.)*

The effect of lead-free gasoline on the durability of catalytic converters and engines was investigated using a domestic car with a 1600 cc engine. After 20,000 km driving over a period of Aug. 1971 to May 1974, the engine was disassembled and the effect on the engine interior was examined. No recession was found in the exhasut valve or valve seat. The carbon deposit on the cylinder, carburetor, intake valve and exhaust valve was markedly higher compared to leaded gasoline. The required octane value for a given engine speed tended to increase with the driving distance; however, the increase was slight after 10,000 km of driving. To evaluate the durability of platinum catalytic converters, the conversion rate for carbon monoxide, hydrocarbons, and nitric oxide were measured after 0, 2000, 6000, 8000, and 10,000 km at driving. There was little variation, and no deterioration in catalytic effect was observed. A definite improvement in durability was noted compared to data on catalytic converters reported by Tokyo Metropolitan Government.

48772 **APTIC NO. 71309**

Inoue, Tatsuo, Hikoroku Honjo, Kimihiko Yoshizaki, and Eiichi Hosoya

PREPARATION METHODS FOR CATALYST SUPPORTERS. *(Shokubai sayo o yusuru seikeihin no seizoho). Text in Japanese. (Nissan Kemetoron Shokubai KK (Nissan Chemetron Catalysts, Ltd.), Tokyo (Japan)) Japan.*

Pat. Sho 49-45067. 2p., Dec. 2, 1974. 5 refs. (Appl. Oct. 9, 1968, 1 claim).

Preparation techniques are described for catalyst carriers, which can be used to oxidize carbon monoxide catalytically in home heaters and stoves. Alumina sol slurries are deposited on fire-resistant or metallic bases. After drying, the treated materials are soaked in solutions of nickel, copper, and chromium salts, where the gravimetric ratios (as oxides) of nickel, copper, and chromium are 1.1-0.9 : 1.1-0.9 : 1.1-0.9. After drying, calcination at 400-500 C is effected. From 1/5 to 1/3 of carbon monoxide was removed by use of catalyst tubes with a Korean-type heater. There was a noticeable subjective decrease in malodors as well.

48773 **APTIC NO. 71310**

Inui, Tomoji

CHOKE VALVE CONTROL APPARATUS. *(Choku ben seigyo sochi). Text in Japanese. (Hitachi Seisakusho, KK (Hitachi Manufacturing, Ltd.), Tokyo (Japan)) Japan. Pat. Sho 49-46008. 3p., Dec. 7, 1974. 2 refs. (Appl. Oct. 26, 1970, 1 claim).*

An automatically operating choke, accurately dependent on engine temperature and air temperature, is described. An electrical circuit including transistors and thermistors is connected to the bimetal which controls choke valve opening. Engine temperature and air temperature are converted into electrical signals which control the flow of electrical current which heats the bimetal.

48774 **APTIC NO. 71058**

Ionescu, Vasile

APPARATUS FOR THE PURIFICATION OF AIR WITH A MERCURY VAPOR CONTENT. *(Institutul de Cercetari si Proiectari, Automatizari si Proiectari, Uzine si Instalatii Pentru Industria Electrotechnica, Bucharest (Rumania)) U. S. Pat. 3,817,713. 2p., June 18, 1974. 5 refs. (Appl. May 10, 1971, 1 claim).*

A method for the purification of air streams containing mercury vapor is described which overcomes prior-art limitations of large installation size or the need for catalyst regeneration. Mercury- laden air is introduced into the top of a chamber and is sprayed with an aqueous sodium sulfide solution (10%). The air is then induced to flow in an undulating path around vertical baffles and through filters which trap any residual droplets before release to the atmosphere. The scrubbing solution is collected in the bottom of the chamber, and the sodium sulfide solution is recirculated. (Author abstract modified)

48775 **APTIC NO. 70683**

Ishihara, Kenji, Tatsuo Tanaka, and Yoshiyuki Toyama

REMOVAL OF TETRAETHYL LEAD FROM GASOLINE-KEROSENE MIXTURES. *(Gasorin-toyu kongobutsu kara no shi echiru namari no jokyo). Text in Japanese. Toyo Daigaku Kogakubu Kenkyu Hokoku (Res. Rep. Fac. Eng., Toyo Univ.), no. 9:31-39, Oct. 1974.*

Gasolines I, II, and kerosene containing 0.25 g/l, 0.22 g/l, and 0 g/l of lead, respectively, and their mixtures were used for the study of Pb removal by extraction with mineral acids or by adsorption on activated clay. To a separatory funnel containing 100 ml of the acid, was added 100 ml of gasoline, kerosene, or their mixture (gasoline:kerosene ratios of 3:1, 1:1, and 1:3). The sample was shaken at 160 times/min for a given period of time and was ashed with water until the washing water became neutral with methyl orange as an indicator. The mixture was then filtered and heated to a given temperature. By the adsorbing method, a 45 cm by 2.5 cm i.d. glass column was packed with a given quantity of activated clay previously heated at 110 deg for 2 hr. The sample was poured at room temperature at a rate such that the solution above the column was kept at 35 cm high. The eluted solution was collected, and lead was analyzed by the JIS K 2260 method. The acid treatments showed that 52% and 88% of Pb were removed by using concentrated sulfuric acid for 25 min and concentrated nitric acid for 30 min, respectively. Diluted acid gave approximately 20% rate of removal. A column with 5 g of the clay powder removed 72% of the Pb, but columns packed with 10, 12, 19, and 32 g removed 100% of the total Pb in the fuels.

48776 **APTIC NO. 71090**

Joannes, Giuseppe

COMBUSTION HEADS FOR BURNERS. *(Finterm S.p.A. Gruppo Finanziario Termico, Turin (Italy)) U. S. Pat. 3,817,685. 4p., June 18, 1974. 5 refs. (Appl. Feb. 16, 1972, 1 claim).*

A burner combustion head design that achieves a smokeless flame by allowing the recirculation of a portion of the combustion products to the vicinity of the flame is described that overcomes prior-art limitations of reduced combustion yields and inflexibility of burner application. Primary air is supplied to a combustion zone through a supply pipe which coaxially surrounds a fuel supply pipe. The latter terminates in a spray nozzle surrounded by a cup. An annular or deflected jet-type ejector device is associated with the primary air supply pipe and is energized by the primary air to cause a low pressure region external to the cup, thus drawing into the head a portion of the burned gases which are recirculated adjacent to the reaction zone for more complete combustion. (Author abstract modified)

48777 **APTIC NO. 71488**

Johnson, Edward B.

COMPOSITION FOR REDUCING CO EMISSION. *(Assignee not given.) 28, 1974. 3 refs. (Appl. Dec. 7, 1972, 7 claims).*

A fuel additive for internal combustion engines running on gasoline or diesel oil is described that results in reductions in carbon monoxide emissions. The additive consists of about 1-4% (by volume) of white oil and about 0.02-0.1% (by volume) of a dialkyl ether containing from one to four carbon atoms in the alkyl groups. A suitable mixture is that of diethyl ether and oil of orange. The fuel additive is mixed with the fuel in an amount of 0.04-1.6% (by volume). Carbon monoxide emissions are reduced by as much as 35%.

48778 **APTIC NO. 70450**

Jutze, George A.

ODOR MEASUREMENT AND CONTROL. *Preprint, 22p., Nov. 13, 1974. 10 refs. (Presented at the Purdue Air Quality Conference, Annual, 13th, Nov. 13, 1974.)*

The measurement and control of odors are reviewed. The only practical way to measure odors is by the use of human odor judges. There are odor standards of intensity and quality designed to fit a number of specific applications. Control applications include thermal oxidation/incineration; absorption and adsorption; and counteraction. Thermal incineration is a suitable process to oxidize organic materials to carbon dioxide and water. Halogens, sulfur, and compounds containing these can be oxidized, but are still contaminants in their oxidized state and are not suitable for processing in thermal incinerators alone. Typical of the types of gases and vapors which can be removed by absorption are hydrogen sulfide, oxides of nitrogen, sulfur dioxide, CO2, carbon monoxide, hydrogen chloride, ammonia, hydrogen cyanide, chlorine, bromine, hydrogen bromine, and many hydrocarbons. The control of atmospheric odor by adsorption is limited to the use of activated carbon as the sorbent because the activated carbon is a nonpolar substance which effectively retains most organic vapors even in the presence of moisture. There are four categories of counteraction: direct addition, spraying, meter feeding, and dispensers.

48779 **APTIC NO. 70861**

Katz, Donald L., Dale E. Briggs, Edward R. Lady, John E. Powers, M. Rasin Tek, Brymer Williams, and Walter E. Lobo

EVALUATION OF COAL CONVERSION PROCESSES TO PROVIDE CLEAN FUELS. PART 1. *Michigan Univ., Ann Arbor, Mich., College of Engineering, Electric Power Research Institute Contract 206-0-0, Proj. EPRI 206-0-0, 77p., Feb. 1974. 75 refs.*

NTIS: PB 234202

A review and evaluation of six general methods of coal utilization involving the elimination of sulfur prior to or during combustion were performed to examine viable alternatives to stack gas cleaning processes. A total of 37 processes were reviewed: five in fluidized bed combustion, onne in coal beneficiation, three in pyrolysis, 22 in coal gasification, and six in coal dissolution and liquefaction. Coal gasification and liquefaction appear to have commercial potential for application to the electric power industry, the natural gas industry, and the petroleum industry. Although the overall heat rate from coal to electricity for combined cycle plants fired with coal-derived gases or liquids cannot match conventional power plants with stack gas clean-up at present, combined cycle turbine developments which permit higher operating temperatures could have lower heat rates than conventional plants. Fluidized bed boilers, pyrolysis, and chemical beneficiation may find application for certain coals, though not on a commercial scale before 1980.

48780 **APTIC NO. 71473**

Kawasaki, Hideo, Masaji Nakaya, Toshihiro Ishii, Shigeaki Hashimoto, and Kenji Usui

REMOVAL METHOD OF NITROGEN OXIDES FROM STACK SMOKE. *(Endogasu kara chisso sankabutsu o jokkyo suru hoho). Text in Japanese. (Nissan Engineering Co., Ltd., Tokyo (Japan)) Japan. Pat. Sho-49-49290. 3p., Dec. 26, 1974. (Appl. Nov. 13, 1972, 1 claim).*

The removal of nitrogen oxides including nitric oxide and nitrogen dioxide is accomplished using an aqueous solution of potassium or sodium permanganate and alkali of potassium or sodium. A mixture of NO and NO2 (total concentration 50 ppm and NO/NO + NO2 ratio 90%) at 30 to 100 degrees was fed to a 300 mm inside diameter interlock saddle packing tower filled with an initial 50 l solution of 5% potassium permaganate and 2% sodium hydroxide. Gas after treatment was released from the top and the resulting solution was pumped to a 10 V electrolytic cell from which the oxidized solution was resupplied to the packing tower.

48781 **APTIC NO. 70343**

Kertz, Walter

CAN GEOTHERMAL ENERGY COVER OUR ENERGY DEMAND? *(Kann Erdwaerme unseren Energiebedarf decken)? Text in German. Umschau Wiss. Tech., 74(21):661-666, 1974. 18 refs.*

Geothermal energy is one of the largest potential energy resources within man s reach. The use of such energy is presently limited to volcanic regions and areas with strong hydro-geological conditions. It may be possible in the future to extract energy from dry hot rocks. The geothermal situation of the Federal Republic of Germany is outlined. Unfortunately, geothermal plants are by no means free of pollution. Waste gases (primarily hydrogen sulfide) and a lot of waste heat are emitted. The environmental problems such plants create are enormous but not insoluble.

48782 **APTIC NO. 70989**

Kihn, Harold E.

VAPOR FUEL CARBURETION SYSTEM. *(The Raymond Lee Organization, Inc., New York) U. S. Pat. 3,817,233). 3p., June 18, 1974. 1 ref. (Appl. Sept. 18, 1972, 3 claims).*

A vapor fuel carburetion system for internal combustion engines is described that results in more efficient engine operation and reduced exhaust emissions. A heating device consisting of electrical windings around the fuel reservoir is used to achieve vaporization of the fuel. The windings may be energized by the vehicle s battery. Air and vaporized fuel are directed to the compression chamber of the engine via a venturi tube. A butterfly valve in the venturi tube controls the flow of vaporized fuel and air to the compression chamber. A water- cooling system is also provided for the fuel reservoir to control the temperature of the fuel. When the fuel is heated to too high a temperature, a temperature sensor opens a flow control valve to supply cooling water to the fuel reservoir.

48783 **APTIC NO. 70905**

Kizim, I. A., I. K. Reshidov, and V. M. Tkachenko

REMOVAL OF ASH FROM FLUE GASES OF POWER STATIONS WITH ELECTROSTATIC PRECIPITATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 119-136. (Jan. 15-18, Paper 6.)*

Design changes leading to increased particulate collection efficiency for electrostatic precipitators used in various electric power plants in the Soviet Union are reviewed. Reverse corona, inefficient rapping, and gas velocities exceeding design values accounted for poor collection efficiencies (80-90%) observed at several power stations. Design changes involved the replacement of pocket or wire collector electrodes with C-formation type electrodes, the substitution of hammer rapping for strike rapping, and the replacement of bar-type corona electrodes with needle-type electrodes. Efficiencies were increased to as high as 97.8% following the modifications.

48784 **APTIC NO. 71228**

Klooster, H. J., G. A. Vogt, and G. F. Braun

DESIGN RELIEF AND FLARE SYSTEMS TO SHOW A PROFIT. *Preprint, American Inst. of Chemical Engineers, New York, 13p., 1974. 4 refs. (Presented at the American Institute of Chemical Engineers, National, Meeting, 78th, Salt Lake City, Utah, Aug. 18-21, 1974.)*

The design of modern relief and flare systems is described. It requires that safety standards be met, environmental regulations be complied with, and energy be conserved. The use of an optimized systems design approach ensures that these objectives are accomplished and, at the same time, provides a return on investment for a system which in the past was only an expense item. Conceptual parameters to consider in all refinery flare system designs are outlines, and the correct application of these criteria to provide a well-designed, optimized relief and flare system is discussed. Objectives of flare design include: provisions for safety; decreasing atmospheric emissions; energy conservation by the recovery and reuse of valuable hydrocarbons as fuel; and minimization of plant siting problems by the reduction of flare emissions, luminescence, noise, and smoke to absolute minimum levels. Several types of flare designs are reviewed including: enclosed flare and relief systems in which all discharges are placed into the flare header; systems which provide for maximum collection, retention, and recycle of liquids and gases discharged into the systems during normal operations and emergency conditions; enclosed systems giving maximum relief load and minimum refinery investment; and enclosed systems giving minimum relief load and maximum refinery investment. Costs for the latter two systems are compared.

48785 **APTIC NO. 71405**

Kobayashi, Hiroshi and Goro Okada

CLINKER COOLING APPARATUS. *(Babcock-Hitachi, Tokyo (Japan)) U. S. Pat. 3,824,068. 9p., July 16, 1974. 3 refs. (Appl. May 18, 1973, 7 claims).*

A clinker cooling apparatus is described which eliminates or greatly reduces pollution from exhaust gas ducts. The apparatus consists of a combination grate type and moving bed type clinker coolers that give high cooling effect and high heat recovery efficiency not attainable by single use of either of the two coolers. The need for a large dust collector necessary in other coolers is eliminated because the exhaust gas is not usually discharged into the outer air. If it is necessary to discharge the gas, the amount is extremely small so that a sufficient dust collecting effect can be attained with a very small dust collector.

48786 **APTIC NO. 71138**

Kokubu, Kazutaka

HOW ARE DESULFURIZERS LOOKED UPON? *(Datsuryu sochi o dou miruka). Text in Japanese. Gendai Kagaku (Mod. Chem), 43(10):58-64, Oct. 1974.*

Desulfurization by hydrogenation was introduced in the early 1950s to facilitate the refining of volatile oil, improve kerosene quality, and to desulfurize intermediate crude oil. Later it was developed as hydrocracking. The indirect and direct methods of hydrogenation desulfurization of heavy oil are reviewed along with the process of desulfurization by gasification. Dry and wet processes of exhaust gas desulfurization are also discussed.

48787 **APTIC NO. 71385**

Kobylinski, Tadeusz P. and Brian W. Taylor

PROCESS FOR REDUCING THE CONTENT OF NITROGEN OXIDES IN THE EXHAUST GASES FROM INTERNAL COMBUSTION ENGINES. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,825,654. 5p., July 23, 1974. 4 refs. (Appl. April 21 1972, 20 claims).*

A 2-stage process for the selective conversion of nitrogen oxides in exhaust gases from internal combustion engines to nitrogen is described. The exhaust gas is contacted at an elevated temperature in a first zone in a reducing atmosphere with a catalyst, such as platinum, that will convert the nitrogen oxides to a product containing ammonia. That product is contacted at an elevated temperature in a second zone in a reducing atmosphere with ruthenium or rhodium to convert the NH_3 to N_2. At least 90 mol% of the NO_x is converted. The product gases can be oxidized in a third stage converter under oxidation conditions to oxidize any unburned hydrocarbons and carbon monoxide to nonpolluting gases. Other catalysts are not suitable for internal combustion engines because they either require an anhydrous environment or utilize hydrogen as the reducing agent which reacts with the NO_x to form excessive NH_3. (Author abstract modified)

48788 **APTIC NO. 71314**

Kondo, Akira, Makoto Mori, and Takanori Takefuji

TREATMENT OF EXHAUST GASES CONTAINING NAPHTHALENE. *(Nafutarin ganyu haigasu no shoriho). Text in Japanese. (Shin Nihon Seitetsu Kagaku Kogyo KK (Shin Nihon Steel Manufacturing Chemistry Industries, Ltd.), Tokyo (Japan)) Japan. Pat. Sho 49-46302. 3p., Dec. 9, 1974. (Appl. June 22, 1970, 1 claim).*

Naphthalene is more easily removed from exhaust gas condensates consisting mostly of steam when the gas is mixed with oil tar in vapor form (over 90% distillation at 160-240 C) before condensation. It is desirable to have over 20% by weight of oil tar with respect to exhaust gas. The gas mixture is introduced into the lower section of an indirectly-cooled condenser tank, and condensate is removed from the bottom of the condenser. Water and oil fractions separate themselves upon settling. Non-condensates are exhausted through the upper section of the condenser.

48789 **APTIC NO. 71372**

Kondo, Akira, Makoto Mori, and Takanori Takefuji

NAPHTHALENE COLLECTION TECHNIQUE FROM EXHAUST GASES. *(Haigasu chu no nafutarin hoshuho). Text in Japanese. (Shin Nihon Seitetsu Kagaku Kogyo KK (Shin Nihon Steel Manufacturing Chemistry Industries, Ltd.), Tokyo (Japan)) Japan. Pat. Sho 49-46303. 3p., Dec. 9, 1974. (Appl. June 22, 1970, 1 claim).*

A collection method for naphthalene in exhaust gases, using a newly-designed condenser, is described. Clogging of condensation installations by naphthalene crystallization is almost completely eliminated. When the exhaust gas condensate consists mostly of steam, with some naphthalene vapor included, the gas is introduced into the lower part of a multi-tube, indirect-cooling condenser tank. Oil tar (over 90% distillation at 160-240 C) is introduced into the upper part of the condenser, above the tubes, and stored there. The oil tar flows downward through the tubes and mixes with the exhaust gas coming up through the tubes. The condensate is removed from the bottom of the condenser. Oil and water layers separate readily upon settling. Non-condensates are exhausted from the top of the condenser.

48790 **APTIC NO. 71308**

Konishi, Jinuemon

METHODS AND INSTALLATIONS FOR REMOVAL OF NOXIOUS COMPONENTS FROM EXHAUST GASES. *(Haigasu kara yugai seibun wo jokyo suru hoho oyobi sono sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-44455. 4p., Nov. 28, 1974. (Appl. Oct. 25, 1971, 2 claims).*

Noxious components of exhaust gases are removed by combining with water vapor, ionizing with ozone, and collecting by electrostatic precipitator. This method is especially applicable to removal of sulfur dioxide. Exhaust gas is introduced with rotary motion into the lower part of an exhaust gas tower, whose sides slope upwards and outwards. The gas spirals upwards, and is trapped with a foamy water mixture of liquid and gas. Ozone, which is formed within the tower from a high-voltage corona discharge, reacts with SO_2 to form particulates of sulfur trioxide, sulfuric acid, and sulfurous acid. Other components combine with water vapor to form particulates also. These particulates are ionized, collected on the charged plate within the exhaust tower, and washed down with water for removal.

48791 **APTIC NO. 71338**

Koze, Hiroki, Shozo Morishita, Takahiko Sato, Tetsuya Ishikawa, and Hiroshi Inoue

EVALUATION AND COUNTERMEASURES FOR ODOR CONTROL (2). *(Akushu no hyoka to taisaku ni kansuru kenkyu (Dai-2-ho)). Text in Japanese. Akushu No Kenkyu (Odor Research J. Japan), 4(17):32-39, Nov. 1974. 62 refs.*

Manure disposal methods used in livestock operations are discussed, with particular application to Gifu Prefecture, Japan. Enclosed buildings for housing cattle, pigs, and chickens are recommended for containment of malodors within limits. However, the animal environment can deteriorate in such cases. Wood shavings and sawdust, the byproducts of lumber mills, are most suitable for spreading on barn floors to adsorb malodors, absorb liquids, and mix with solid wastes for disposal. Collected manure can be used as fertilizer or as feed after suitable treatment. Flow diagrams of waste disposal, and tables of waste treatment, sawdust production, malodor sources, and pollution compliants are included.

48792 **APTIC NO. 70914**

Kurkin, Valery P.

BASES OF GAS FILTRATION THROUGH POROUS MEDIA THEORY. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Con-*

trol Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 373-384. (Jan. 15-18, Paper 16.)

A mathematical analysis of aerosol filtration through porous media (fiber filters) is presented. The filtration process is divided into two stages: a stationary stage and a non-stationary stage of filtration. During the first stage, prior to any aerosol deposition on the filter, the collection efficiency and hydraulic resistance do not change with time, and their values are determined only by the structure of the filtering media and the parameters of the gas stream. The second stage occurs when pores of the filtering surface become filled with aerosol particles, and in a short time a secondary porous structure is formed which plays a role in particle collection. The layer of particles increases collection efficiency but also increases hydraulic resistance of the medium. A mathematical expression is given for describing all cases for deposition of solid dispersive aerosol during the non-stationary filtration phase.

48793 **APTIC NO. 70918**

Kurkin, Valery P.

REMOVAL OF CARBON BLACK FROM INDUSTRIAL GASES. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 479-488. (Jan. 15-18, Paper 20.)*

Collection methods used in the Soviet Union for the removal of carbon black and soot from waste gases are reviewed. Electrostatic precipitators are used for the recovery of lampblack and oil-based furnace blacks after a mixture of the gas and black is cooled in a scrubbing tower to 180-239 C. Collection efficiencies of 98-99% are possible when the gas velocity does not exceed 0.5-0.6 m/sec. Dry methods of collection include the use of cyclones and filter fabrics (glass). Cyclones can be used to remove carbon black from arc furnaces with an efficiency of about 78%. Subsequent washing and filtering procedures significantly increase the amount of carbon black removed. Filtration appears to be the most promising method of collecting carbon black in residual oil gasification, a process which is complicated by the pressure of the gas.

48794 **APTIC NO. 70976**

LaHaye, Paul G., Glenn D. Craig, and Joseph L. Turecek

METHOD AND APPARATUS FOR REMOVING NITROGEN OXIDES FROM A GAS STREAM. *(Aqua-Chem, Inc.) U. S. Pat. 3,816,595. 3p., June 11, 1974. 2 refs. (Appl. Nov. 15, 1971, 7 claims).*

A method for the removal of nitrogen oxides from gaseous streams is described. The process involves passing the gas effluent over or through a reactive matrix of silicon carbide at a temperature of at least 1000 F. The nitrogen oxides in the gas stream react with the silicon carbide to form non-gaseous oxides and nitrides which are occluded in or on the carbide. The process may take many forms and is adaptable to the employment of reactive filters of carbide in the combustion path of boilers, heaters, furnaces, engines, and other combustion devices.

48795 **APTIC NO. 71287**

LaMantia, Charles R. and Irwin A. Raben

SOME ALTERNATES FOR SO2 CONTROL. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 153-161. 1 ref. (Oct. 22-24.)*

Field applications of various scrubbing alternatives to lime/limestone processes are outlined. A sodium carbonate scrubbing system was installed at a Nevada power station to take advantage of the unusually high evaporation rates at the site for the disposal of the scrubber effluent salt solution. The use of soluble sodium salts instead of slurries of calcium salts offered greater reliability and circumvention of scaling problems encountered with calcium processes. The system met the guaranteed outlet requirements for SO2 (less than 50 ppm) and particulates (less than 0.02 gr/scfd). A lime/alkali fly ash scrubbing process was installed at a Montana power plant burning a coal with a high ash content, thus utilizing the natural lime alkalinity in the fly ash to satisfy the alkali requirement for SO2 removal. Pilot tests revealed the need for incorporation of a tray and recirculation loop into the system to improve mist eliminator performance and reliability. A dual-alkali scrubbing process using sodium hydroxide for SO2 absorption and lime for regeneration of the sodium scrubbing solution is currently being developed to overcome inherent difficulties of direct calcium slurry scrubbing. The dual alkali system provides for higher SO2 removal efficiencies (over 97%) as compared to practical removal efficiencies of 80-90% for direct calcium systems.

48796 **APTIC NO. 70425**

Land, George W.

STATUS OF FLUE GAS DESULFURIZATION PROJECTS. *Preprint, Amax Coal Co., 69p., May 1974.*

The status of flue gas desulfurization projects of 36 utility and industrial companies is summarized. The results of a telephone survey showed that no one system or process is being extensively used, but more lime and limestone scrubbers are being tried than any other type. The expenditures necessary for modifications to cover operating and maintenance problems are higher than expected. The systems that are being used include: ammonia scrubbers, cat-ox catalyst conversion, citric acid scrubber, dry absorbent, dry lime injection (Corson), lime (calcium hydroxide) wet scrubber, limestone slurry wet scrubber, magnesium oxide slurry scrubber, molten carbonate scrubber, organic compound absorption plus scrubber, potassium formate wet scrubber, sodium carbonate wet scrubber, sodium hydroxide absorbent with electrolytic regeneration, sodium hydroxide wet scrubber with lime regeneration, and water scrubbers for ash particulate.

48797 **APTIC NO. 71014**

Le Vaguerese, P., M. P. Heap, and T. M. Lowes

THE REDUCTION OF POLLUTANT EMISSIONS INTO THE FLAMES OF FOSSIL FUEL. *(La reduction des emissions de polluants dans les flammes de combustibles fossiles). Text in French. Rev. Gen. Thermique (Paris), 13(154):729-746, Oct. 1974. 14 refs.*

The formation of nitric oxide in turbulent diffusion flames was studied to determine the optimum burner parameters for minimization of NO emissions. Optimization of the type of fuel injection and the distribution of combustion air were the most effective means of reducing NO emissions from fuel-oil or pulverized-coal flames. Combustion air optimization resulted in only slight NO emission without changing the thermal characteristics of the flame and suggested the usefulness of staged combustion. Extension of the studies to the simultaneous control of NO and unburned hydrocarbons revealed that the latter could be controlled by using an emulsion of fuel oil and water as the fuel.

48798 **APTIC NO. 70909**

Lebedyuk, Georgy K.

USE OF VENTURI SCRUBBERS FOR REMOVAL OF HIGHLY DISPERSIVE PARTICULATES. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 213-220. 2 refs. (Jan. 15-18, Paper 10.)*

The use of venturi scrubbers for particulate removal from gas streams is reviewed. Venturi scrubbers are very efficient in the removal of highly dispersive particulates, and pressure drops of 10,000-30,000 n/cu m can be used for the removal of micron and submicron particulates. Collection efficiencies approaching 97% can be achieved for 1 micron particles, and efficiencies of over 99% are possible for particle diameters of 2 micron. In some applications two-level scrubber schemes are

preferable to single scrubber gas cleaning. The first scrubbing stage cools and stabilizes the gas at a low energy expenditure for subsequent high energy scrubbing at high collection efficiencies.

48799 **APTIC NO. 70910**

Lebedyuk, Georgy K., A. Y. Valdberg, and F. Y. Dubinskaya

WET GAS CLEANING IN IRON AND STEEL INDUSTRY. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 221-238. 2 refs. (Jan. 15-18, Paper 11.)*

Wet scrubbing methods for the control of particulates from gases of converters, closed melting furnaces, open-hearth furnaces, and electric furnaces in the iron and steel industry are reviewed. Open-spray scrubbers are used as a condition step for cooling and humidifying the gas as well as for removing large particles. The efficiency of gas cleaning with open spray scrubbers can be increased with the use of the condensation effect which occurs during the cooling of the gas. Maximum efficiency of collection is attained at highest condensation levels. Venturi scrubbers are used for the removal of fine particulates. One venturi pipe is used for small gas volumes, while battery venturi scrubbers are employed for large volumes. Two-step venturi scrubbers, comprising a low-pressure system for cooling and humidifying the gas followed by a high-pressure system, are particularly effective for fine particulate control. Low-pressure venturi scrubbers can also be used to pre-clean gases from blast furnaces prior to wet electrostatic precipitation.

48800 **APTIC NO. 70912**

Lebedyuk, Georgy K., B. I. Myagkov, I. G. Kamenshchikov, and V. V. Malikov

HIGH VELOCITY SYNTHETIC FIBER MIST ELIMINATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 317-328. 4 refs. (Jan. 15-18, Paper 14.)*

Fiber mist eliminator developments in the Soviet Union are reviewed. Polypropylene materials are particularly suited for mist eliminators because of their chemical stability and mechanical strength. Such materials can be used for the elimination of both acid and alkaline mists. A needle punching method of fiber layer formation results in filtering felts of favorable texture for mist elimination. Felts with fibers of 50-80 micron in diameter are being used with filtration velocities of 5-9.5 m/sec and pressure drops of 120-750 mm water. Mist elimination efficiency is 95.4% at filtration velocities of 4.5-7 m/sec and hydraulic resistivity changes of 140-650 mm water. Filtration areas range from 0.55-1.5 sq m, corresponding to gas volumes of from 1500-30,000 cu m/hr with filtration velocities of 1-5 m/sec.

48801 **APTIC NO. 71075**

Lenane, Denis L.

EXHAUST SYSTEM. *(Ethyl Corp., Richmond, Va.) U. S. Pat. 3,815,337. 9p., June 11, 1974. 10 refs. (Appl. June 23, 1972, 11 claims).*

A cyclone-type inertial separator which can be built into the muffler of an automobile for the collection of particulate matter in engine exhaust is described. The unit achieves higher collection efficiency and less particle re-entrainment than prior-art devices by providing reject holes in the side wall of the cyclone chamber rather than in the bottom plate. Particulates are rejected through the side wall slots into a collection chamber which can be filled with a porous material such as wire mesh or expanded metal. The bottom of the cyclone chamber is a non- perforate plate. Performance can be improved by including an agglomeration unit between the engine and the separator. The placement of a filter unit downstream from the separator can result in further improvement of particulate collection. (Author abstract modified)

48802 **APTIC NO. 71296**

Lenane, Denis L.

EXHAUST SYSTEM. *(Ethyl Corp., Richmond, Va.) U. S. Pat. 3,815,338. 4p., June 11, 1974. 2 refs. (Appl. March 20, 1973, 15 claims).*

A device for removing particulates from internal combustion engine exhausts is described. The device consists of an inertial particulate trap that has a cylindrical cyclone housing with reject slots in the side wall proximate to, but not abutting, a non- perforate bottom closure. The entrance compartment adjoining the cyclone chamber contains a circular guide vane which directs the incoming gas through a circular tunnel from a tangential inlet to the entrance of the cyclone chamber. The tunnel contains a pervious material having a high surface to volume ratio (e.g., pieces of expanded metal lath). Downstream from the trap is a filter unit which removes residual particles that escape the trap. (Author summary modified)

48803 **APTIC NO. 70904**

Levitov, V. I., I. K. Reshidov, and V. M. Tkachenko

THEORETICAL BASIS FOR DESIGN OF MODERN HIGH-EFFICIENCY ELECTROSTATIC PRECIPITATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 97-118. (Jan. 15-18, Paper 5.)*

Theoretical design considerations leading to improved particle collection efficiency for electrostatic precipitators are reviewed along with results from field tests incorporating such changes. The C-formation collector electrodes appear to distribute current more evenly on their surface than do plate electrodes, and reverse corona formation is reduced with the former type of collector electrode. Corona electrodes of the needle type exhibit current densities and coefficients of non-uniformity that are five to seven times smaller than for electrodes of the cylindrical or bar crossection type. The redesign of a cement plant precipitator, involving the replacement of bar conductors with needle electrodes (80 mm spacings) and the replacement of channeled collector electrodes with C-formation wide band electrodes, resulted in an increase in collection efficiency from 86% to 98.4% during field tests.

48804 **APTIC NO. 71454**

Luzsa, Istvan

POSSIBILITIES OF EMISSION AND POLLUTION ABATEMENT AT OIL FIRINGS IN HUNGARY. *(Az emisszio es immisszio csokkentesenek lehetosegei hazai olajtuzeleseinknel). Text in Hungarian. Energiagazdalkodas, 15(9):403-407, Sept. 1974. 6 refs.*

Current problems and possibilities of oil firing equipment-generated emission abatement in Hungary are discussed. As flue gas desulfurization is technically not yet feasible, the only possibility to abate sulfur dioxide emissions is to desulfurize fuel. As fuel desulfurization would require considerable investments, no further expansion of the desulfurization capacities is planned; rather, the purchase of low-sulfur crude oil is envisaged. The use of low-sulfur and desulfurized fuel would be essentially important in the winter period, which is impossible due to the lack of adequate storage capacities. The SO2 concentrations around large-capacity oil-firing equipment can be efficiently abated by the use of high stacks, which at the same time offer an optimum solution to the problem of nitrogen oxides emissions. The considerable problems created by carbon monoxide, coke, and soot emissions, especially from obsolete equipment, can be solved by modernization rather inexpensively.

48805 **APTIC NO. 71401**

Maget, Henri J. R.

ELECTROCHEMICAL SULFUR DIOXIDE ABATEMENT PROCESS. *(Electronic Associates, Inc., Long Branch, N.*

J.) U. S. Pat. 3,824,163. 9p., July 16, 1974. 2 refs. (Appl. July 19, 1972, 5 claims).

A process and apparatus for removing pollutants from waste gases and electrochemically converting them into a desired form are described. A waste gas stream is scrubbed with a slurry of pollutant absorbent particles suspended in slightly acidic aqueous solution causing the pollutants to be adsorbed by the particles. The slurry is electrochemically treated to convert the pollutants into a useful product or into a less toxic or less noxious material. The process is particularly adapted for removal of sulfur dioxide from waste gases and converting it into sulfuric acid. Other pollutants such as carbon monoxide, hydrocarbons, ammonia, hydrazine, hydrogen sulfide, and oxides of nitrogen can be effectively and efficiently removed and converted. The capability of handling substantially any type of waste gases regardless of the concentration of pollutants is the main advantage of this process over existing systems which can handle gases of only very specific pollutant concentrations. The system can be used as an add-on process to substantially any existing plant.

48806 **APTIC NO. 70428**

Mantle, E. C.

PREVENTION OF AIR POLLUTION IN THE NON-FERROUS METALS INDUSTRIES. *BNF Metals Technology Center, Oxon (England), 207p., 1974. 132 refs.*

Methods for the assessment, prevention, and control of air pollution from the non-ferrous metals industries (primary smelting of copper, lead, zinc, and aluminum; melting and casting of non-ferrous metals and their alloys; and secondary metallurgical operations) are reviewed. Pollutants associated with such operations include: sulfur dioxide and sulfur trioxide, fluorides, dusts containing metals, metal oxide fumes, and solvent vapors. Prevention and control measures include: pretreatment of materials, fume containment and ducting, reduction of pollution by dispersal (stacks), and various collection methods. Principles of collection are discussed in terms of settling chambers, cyclone collectors, wet scrubbers, filters, and electrostatic precipitators. Sampling and monitoring requirements are reviewed in terms of techniques applicable to measurements in ducts or stacks, indoor atmospheric measurements, and outdoor ambient measurements. Threshold limit values for substances in workroom air (American Conference of Governmental Industrial Hygienists, 1972) are also reviewed in an appendix.

48807 **APTIC NO. 71283**

Martin, J. R., B. M. Minor, and A. L. Plumley

THE C-E LIME WET SCRUBBING PROCESS FROM CONCEPT TO COMMERCIAL OPERATION. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 87-101. (Oct. 22-24.)*

Pilot and full-scale field trials of a lime scrubbing system for the removal of sulfur dioxide from power plant stack gases are reported. Calcium hydroxide sludge, a by-product from the manufacture of acetylene from calcium carbide, was used as an additive in the wet scrubber system. A prototype 12,000 CFM prototype scrubber system operated continuously for more than 20 hr with an SO2 recovery efficiency of 90% using about 100% stoichiometric makeup of carbide lime to maintain the under-bed spray pH at about 10. The system remained very clean. An SO2 removal efficiency of about 87% was maintained during closed-loop tests. Cotninuous testing of a full-sized scrubbing system on a 65 MW steam plant boiler demonstrated SO2 removal efficiencies of greater than 85%, with outlet dust loadings of between 0.030 and 0.040 gr/dscf. No operating problems were encountered.

48808 **APTIC NO. 70426**

Matheson, K. H., Jr., R. R. Beck, R. J. Heaney, and C. K. Lewis

EMISSION CONTROL EFFORT AT KENNECOTT S UTAH SMELTER. *Preprint, American Inst. of Chemical Engineering, New York, 47p., Aug. 21, 1974. 2 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 78th, Salt Lake City, Utah, Aug. 18-21, 1974.)*

Efforts to determine the extent of sulfur emissions, their sources, and control systems at Kennecott Copper s smelter in Salt Lake City, Utah are summarized. Computer simulation of the smelter gas handling system was used to predict the sulfur dioxide concentration. Successful abatement required that sulfur fixation be over 80% and that captured building emissions and acid plant tail gas must be sent to a 1200 ft stack. The Noranda Continuous Smelting Process was selected over other processes, in part, because there is no need for separate visible or particulate emission control facilities, and fugitive emissions are held to a minimum. The process has the lowest capital cost and lowest potential operating cost. The smelter is being almost completely rebuilt to meet air quality standards at an estimated cost of $175 million.

48809 **APTIC NO. 71369**

Matsui, Kazuma and Taku Yamada

FUEL SUPPLY APPARATUS FOR INTERNAL COMBUSTION ENGINES WITH EXHAUST GAS PURIFICATION DEVICE. *(Haiki gasu joka kino o yusuru nainen kikan no nenryo kyokyu sochi). Text in Japanese. (Nihon Denso KK (Japan Electric Equipment Co., Ltd.), Kariya City (Japan)) Japan. Pat. Sho 49-45645. 8p., Dec. 5, 1974. 1 ref. (Appl. July 8, 1969, 1 claim).*

A compressed air nozzle, mounted a set distance away from and perpendicular to the direction of flow between the fuel nozzle and the lead-in tube to the engine, is used to modify the direction of fuel flow as engine behavior is varied. Fuel is supplied from the fuel nozzle at constant pressure or constant flow rate. Compressed air, controlled by electrical pulses, is introduced to deflect the fuel flow from the lead-in tube, as engine load and revolution vary. During rapid deceleration, the supply of compressed air to the compressed air nozzle becomes continuous. Without use of mechanically moving parts, the proper amount of fuel at the proper time is supplied to the engine. Fuel supply is shut off in event of failure of the compressed air pump. The compressed air pump also mixes compressed air with exhaust gas to oxidize carbon monoxide and unburned hydrocarbons.

48810 **APTIC NO. 71137**

Maubon, Andre

DEVICE FOR COLLECTING GASES FROM A CONVERTER. *(Creusot-Loire Enterprises, Paris (France)) U. S. Pat. 3,814,402. 6p., June 4, 1974. 2 refs. (Appl. July 9, 1973, 5 claims).*

A device for collecting particulate-laden gases from converters for subsequent dust collection treatment is described that achieves more complete collection of the gases to be treated than prior-art devices, thus eliminating the need for secondary dust-extraction devices. The device consists of the following components: a hood for connection to the dust-collecting installation; a skirt connected in fluid-tight manner to the hood and mounted in a stationary manner; a canopy surrounding the converter spout and connected to the skirt in fluid-tight manner, a shutter for closing a cut-away in the canopy; and a pressure control means for maintaining the pressure within the skirt equal to that outside of the skirt. (Author abstract modified)

48811 **APTIC NO. 71133**

McKinney, Joel D. and John A. Paraskos

CONTROL OF ASPHALTIC OIL HYDRODESULFURIZATION PROCESS. *(Gulf Research and Development Co., Pittsburgh, Pa.) U. S. Pat. 3,814,681. 13p., June 4, 1974. 9 refs. (Appl. Dec. 8, 1971, 9 claims).*

A method for the hydrodesulfurization of asphaltic oil is described that precludes the need for either blending such materials with lighter oils or converting the asphalt content of such oils to lower-boiling products. As the asphaltic oil passes through a hydrodesulfurization zone and the aromatic content of the oil increases, the extent of desulfurization is controlled in response to the quantity of aromatics produced in situ. The aromatics act as a solvent for the asphaltic material and enable this material to be desulfurized without its being excessively converted. Control of the desulfurization such that the asphaltic oil is hydrodesulfurized in the presence of a continually increasing percentage (by weight) of aromatics results in optimum desulfurization without excessive cracking.

48812 **APTIC NO. 70922**

Melcher, J. R. and K. S. Sachar

SYSTEMS OF CHARGED PARTICLES AND ELECTRIC FIELDS FOR REMOVING SUB-MICRON PARTICLES. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 563-596. 4 refs. (Jan. 15-18, Paper 24.)*

Experiments with charged droplets are described that support the time constant picture of electrostatic agglomeration and self precipitation processes among particles in the sub-micron range as well as for other size ranges. Charged droplets, used as collection sites for charged particulates, result in a class of devices which combines the characteristics of a conventional scrubber and a conventional electrostatic precipitator. Electrically induced impaction is demonstrated to easily dominate that due to inertia; thus, electrically augmented scrubbers are attractive when compared to inertial impact scrubbers. However, the fact that self-precipitation can make such an appreciable contribution to the removal efficiency suggests that the charged drop scrubber is poor competition for the conventional electrostatic precipitator. Breakthroughs in residence time for efficient cleaning are nevertheless possible by using dense systems of particle collection sites in an imposed electric field. Such devices could outperform the electrostatic precipitator in terms of residence time and provide new alternatives in solving problems such as the removal of high resistivity particles.

48813 **APTIC NO. 71267**

Miller, Terry L.

CONTROLLING RENDERING PLANT ODORS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 81-103. 10 refs. (March 18-19.)*

Methods for the control of rendering plant odors are reviewed. Such methods include: good housekeeping and rapid handling of material, odor counteraction with masking agents, wet scrubbing and other absorption techniques, adsorption with activated carbon, incineration, and condensation of odorous vapors. Incineration is the principal method for completely controlling rendering plant odors, though it is relatively expensive if used to eliminate low odor concentrations in large gas volumes. Packed towers containing activated carbon and wet scrubbing techniques are much more effective in deodorizing large volumes of air which contain low concentrations of rendering odors. Masking agents which cost about $500 per 55 gallon drum are effective for some odor problems but are not usually employed as the final step for reducing rendering odors prior to exhaust to the atmosphere. The utilization of condensers on exhaust vapors from cookers is almost universal, and the condensers can be either of the direct contact type or the surface type. Following condensation of such odors, incineration can be employed to destroy the odorant compounds. Capital and operating costs are outlined for several odor control systems.

48814 **APTIC NO. 71288**

Minnick, L. John and David R. Maneval

UTILITIZATION OF FLY ASH-SULFATE SLUDGE BASED SYNTHETIC AGGREGATE FOR HIGHWAY CONSTRUCTION USE. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 162-181. 5 refs. (Oct. 22-24.)*

The use of fly ash and sulfate/sulfite sludges generated from sulfur dioxide removal processes for highway construction and aggregate needs in West Virginia is discussed. Three primary ingredients, fly ash, sludge, and lime, can be mixed in conventional highway material blending equipment, and the finished products can readily be produced in stabilization plants located at sites close to sources of the ingredients. The compositions can be laid down in a monolithic form by a spreader box, extruded into various shapes, pelletized through a pelletizing pan, or cast into blocks for later crushing. Tests of selected stabilized road base mixtures show 28-day compressive strengths ranging from 490-1090 psi.

48815 **APTIC NO. 71368**

Miwa, Makoto, Tadanori Sato, and Yoshihito Ikeda

TWO-CYCLE GASOLINE ENGINE OF PARTIAL FUEL BLOCKAGE TYPE. *(Nenryo ichibu shadan shiki 2-saikuru gasorin kikan). Text in Japanese. (Fuji Jukogyo KK (Fuji Heavy Industries, Ltd.), Tokyo (Japan)) Japan. Pat. Sho 49-45643. 3p., Dec. 5, 1974. 1 ref. (Appl. Dec. 9, 1969, 1 claim).*

A device to compensate for irregular combustion in 2-cycle engines during idling or deceleration is described. An automatic relief valve, connected with the accelerator or the throttle valve, is used to block part of the fuel system, so that fuel access to one of the cylinders is blocked. The engine runs on one cylinder. The load on this cylinder is correspondingly high, and irregular combustion is avoided.

48816 **APTIC NO. 71065**

Miyashita, Tsuneo and Leon Michel Chaussy

METHOD AND APPARATUS FOR SEPARATING AND COLLECTING FINE PARTICLES IN GAS WITH STREAM OF FALLING MOLTEN METAL DROPS. *(Nippon Kokan Kabushiki Kaisha, Tokyo (Japan)) U. S. Pat. 3,823,530. 5p., July 16, 1974. 5 refs. (Appl. Dec. 18, 1972, 7 claims).*

A method for the removal of fine particles such as soot from hot gases is described which, unlike prior-art methods, permits separation and collection without reducing the gas temperature. Moreover, the gas is kept out of contact with the air. The hot soot-laden gas is passed countercurrently to a stream of falling molten metal drops such that the soot is removed by attachment to the molten metal drops. The soot particles flow into a static bath of the molten metal and remain on the surface of the bath.

48817 **APTIC NO. 70459**

Monroe, E. S.

THE CYCLONIC INCINERATOR. *Preprint, du Pont de Nemours (E. I.) and Co., Inc., Wilmington, Del., 13p., 1974 (?).*

The development of a cyclonic incinerator is described through its three stages, starting with the open pit. Rectangular cyclonic incinerators, cyclonic incinerators, and single versus multichamber construction are also discussed. Test data are given showing the completeness of combustion. The continued acceptance of the open pit incinerator and the development of the enclosed cyclonic incinerator demonstrate the advantages of the good combustion characteristics inherent in the design. The ability to handle high vaporization loads such as aqueous wastes with simple injectors and without impingement is a decided advantage over the vortex type burner with its higher heat release. Automation can be applied to both types for optimum control of firing rates and temperature control. The cylindrical cyclonic unit provides primary separation of particulate matter in the furnace and potentially reduces the number of applications requiring scrubbers. (Author abstract modified)

48818 **APTIC NO. 70333**

Mori, Kenji, Kei Utsunomiya, Kazuya Soga, Katsunori Shimasaki, Yutaka Mito, and Mamoru Aoki

REDUCTION OF NO Y NH3 ON METAL OXIDES. *(Kinzoku sankabutsujo ni okeru NO no NO3 ni yoru kangen). Text in Japanese. Preprint, Japan Chemical Society, Sendai, p. 655, 1974. (Presented at the Japan Chemical Society, Fall Meeting, 31st, Sendai, Japan, Oct. 2-5, 1974, Paper 2Q17.)*

Reduction of nitric oxide by ammonia on various metal oxide catalysts was investigated. Decomposition of NH3 during the process was also studied. At 400 C, 80-100% NO removal occurred for oxide catalysts of copper (100%), chromium (80%), and vanadium (80%). However, use of Cu and V resulted in large amounts of NH3 decomposition, unless the catalysts were reduced with hydrogen prior to use. There was very little NH3 decomposition with Cr catalysts, whether treated or untreated with H2.

48819 **APTIC NO. 71018**

Morozumi, Kiyoshi, Fumio Kanoh, Minoru Aoki, and Kengo Oshiro

STUDIES ON AIR CLEANING EFFICIENCY FOR DUSTS AND HEAVY METALS BY AIR CONDITIONING. *(Kuki joka ni kansuru kenkyu: kucho kiki niyoru funjin narabini jukinzokurui no hoshuritsu). Text in Japanese. Tokyo-Toritsu Eisei Kenkyusho Kenkyu Nenpo (Ann. Rept. Tokyo Metrop. Res. Lab. Public Health), no. 25:331-335, Aug. 1974. 3 refs.*

Filter efficiency in office air conditioning equipment was monitored for dust and lead to examine health conditions for 1 yr in Tokyo. Filter efficiency was calculated by obtaining the ratio of the concentrations of dust and Pb in the air at both inlet and outlet filter sides. The dust, CO, and Pb are analyzed by a dust counter, a non-dispersive infrared spectrometer, and atomic absorption spectrometry, respectively. Three different locations of air inlet in the building were studied. There was only a small seasonable variation in the CO concentration; however, the difference in air inlet location was greatly influenced by the environment surrounding the inlet. The maximum CO concentration was 4.6 ppm, which is well below the office CO standard level (10 ppm). The dust amount varied both with location and month, but the amount at the filter outlet was well below the recommended health standard. The distribution of dust size was 0.3 micron to 10 micron, and 98% of the dust was 0.3 micron to 1.0 micron. The filter effficiency of the regular filter (medium quality) for dust was 7.9% to 28.6% depending on the location, time, and dust concentration. The filter efficiency for Pb was 7.36% to 40.5%, also depending on the location of air inlet. Generally the efficiency was good if the air inlet was located near ground level. Consideration of the optimum place of the air inlet for controlling indoor air pollution by air conditioning is therefore necessary.

48820 **APTIC NO. 71071**

Moss, William A.

EMISSION CONTROL MUFFLER MEANS AND METHOD. *(Assignee not given.) U. S. Pat. 3,815,328. 5p., June 11, 1974. 5 refs. (Appl. July 3, 1972, 9 claims).*

A flowing-liquid muffler for the reduction of exhaust emissions for internal combustion engines is described. An exhaust gas receiving compartment and an exhaust outlet compartment define a passage for the flowing liquid which may be water. The exhaust gas is passed through an initial stationary liquid reservoir, filtered above the liquid level, and then passed through a second stationary liquid reservoir. The exhaust gas is again filtered and passed to the outlet. A portion of the gas with entrained liquid, however, is carried back to the first compartment to maintain a constant level of liquid in both compartments of the reservoir.

48821 **APTIC NO. 71302**

Motoyama, K.

FUEL ADJUSTMENT APPARATUS FOR INTERNAL COMBUSTION ENGINES. *(Nainen kikan no nenryo chosetsu sochi). Text in Japanese. (Tokyo Shibaura Electric Co., Ltd., Kawasaki (Japan)) Japan. Pat. Sho 49-45641. 3p., Dec. 5, 1974. 1 ref. (Appl. Sept. 13, 1969, 1 claim).*

Fuel flow in an internal combustion engine is controlled by an electrical circuit which is activated by the amount of load. At least two electrodes are mounted along the driving axle in the longitudinal direction between the load and the engine. As the axle rotates, the electrodes come into intermittent contact with corresponding stationary electrodes. Changes in electrostatic capacity are represented by electrical pulses. Analysis of these pulses results in fuel supply regulation.

48822 **APTIC NO. 71061**

Moy, David and William M. Caldwell, Jr.

ORGANIC SMOKE SUPPRESSANT ADDITIVE AND DISTILLATE HYDROCARBON FUEL COMPOSITIONS CONTAINING SAME. *(Cities Service Oil Co., Tulsa, Okla.) U. S. Pat. 3,817,720. 4p., June 18, 1974. 8 refs. (Appl. Aug. 30, 1972, 8 claims).*

A completely organic smoke suppressant additive suitable for use with distillate hydrocarbon fuels in diesel or jet engines is described that overcomes shortcomings of prior-art metal- containing smoke suppressant additives involving thermal instability, poor water tolerance, poor oxidative stability, tendency toward gel formation, formation of crankcase deposits, clogging of fuel injectors, and the emission of metal compounds. The additive consists of an ether of hydroquinone and a mixture of isopropyl alcohol and diacetone alcohol. The distillate hydrocarbon fuel may be diesel fuel, jet fuel, or number 2 burner fuel. The smoke suppressant is added to the distillate in amounts ranging between 0.2 and 2.0 weight%.

48823 **APTIC NO. 70627**

Murakami, Motomata

REMOVAL METHOD AND APPARATUS FOR UNURNED GASES AND SMOKE IN INCINERATOR. *(Shokyakuro ni okeru baien oyobi fukanzen nensho gasu no jokyo hoho narabini sono sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-49072. 5p., Dec. 25, 1974. (Appl. April 6, 1971, 2 claims).*

The removal method and device for incompletely combusted gases from an incinerator used for disposal of plastic scraps are described. The incinerator system consists of primary and secondary combustion chambers, a vaporization chamber, a horizontal flue with several spray washing chambers placed in a series, and corresponding water tanks for collecting sprayed water. The water is supplied to the last spray chamber, collected in the bottom tank, and then supplied to the adjacent spray chamber, repeated the same process until it reaches the vaporization chamber. The spray water is heated while passing through the spray chambers and finally vaporized in the vaporization chamber. The vapor produced is led through the flue and spray chambers with exhaust gas capturing smoke and toxic gases, which is condensed in spray chambers and returned to water tanks, thus circulating in the system while cleaning the exhaust gas.

48824 **APTIC NO. 71132**

Murray, Michael F.

APPARATUS FOR ENCAPSULATING HOT GASES FROM HIGH STACKS. *(Assignee not given.) U. S. Pat. 3,814,394. 5p., June 4, 1974. 12 refs. (Appl. Nov. 17, 1971, 14 claims).*

A method for encapsulating particulate-laden stack gases is described. The hot gas remains encapsulated in a bubble until the bubble bursts at high altitude, thus achieving more effective dispersion of the stack emissions. Encapsulation is achieved by creating a high stack draft and by subjecting the gases leaving the stack to a bubble-forming medium such as latex. A continuously rotating screen wheel with a wire mesh for supporting the bubble medium is used to subject the stack gases to bubble formation. The screen is continuously applied with the bubble- forming medium by a sponge impregnated with the latter. (Author abstract modified)

48825 **APTIC NO. 71063**

Nakajima, Yasuo, Toru Yoshimura, and Shin-Ichi Nagumo

METHOD AND APPARATUS FOR REDUCING TOXIC COMPOUNDS IN EXHAUST GASES FROM COMBUSTION TYPE POWER PLANT. *(Nisson Motor Co., Ltd., Yokohama City (Japan)) U. S. Pat. 3,817,232. 14p., June 18, 1974. 5 refs. (Appl. June 20, 1972, 11 claims).*

A method for the reduction of toxic compounds, particularly nitrogen oxides, in exhaust gases from automobile engines and industrial boilers is described which requires no compromise in operating conditions and no add-on pollutant removal devices as in prior-art control methods. The method involves mixing the fuel for the power plant with dentrified air, recirculated exhaust gases, and, if desired, additional fresh air. The denitrified air can be obtained, for example, from a nitrogen separating means using a nitrogen impermeable membrane. Deterioration of the nitrogen separating ability is cyclically remedied through periodic purging of the nitrogen separating apparatus. Compared to conventional combustion systems, nitrogen oxides are reduced by about 95%; while hydrocarbons, carbon monoxide, and sulfides are reduced by about two-thirds. (Author abstract modified)

48826 **APTIC NO. 70542**

Nakata, Masahiko, Masato Yokota, and Nobuyuki Kobayashi

EXHAUST GAS COUNTERMEASURES AND CAR OPERATION. REPORT NO. 1: METHOD FOR AN OJECTIVE EVALUATION OF DRIVEAILITY. *(Haiki gasu taisaku tu untensei, dai-1-po: untensei no kyakkanteki hyoka hoho). Text in Japanese. Preprint, Society of Automotive Engineers of Japan, p. 385-396, 1974. 6 refs. (Presented at the Society of Automotive Engineers of Japan Meeting, Oct. 15-17, 1974.)*

For the measurement of vehicle surging, an accelerometer pick-up was installed by the rear seat and a torque-meter was installed on the propeller shaft. The cycle change of the engine is a primary cause for surging, however, it is not directly related to surging. The engine surging (bench test) was also measured and the torque variation (engine surging) on the propeller shaft showed a good correlation to the forward and backward acceleration variation of the vehicle (vehicle surging). Therefore, the estimation of surging of vehicles can be made based on the engine surging. The vibrational frequency of the engine system is generally in the low frequency range of less than 20 Hz, which corresponds to the frequency range of forward and backward vibration most sensitively felt by humans. The formation mechanism of vehicle and engine surging originating in the cycle change of the engine is described. For the evaluation of vehicle surging, the evaluation by the average amplitude of forward and backward acceleration variation seems to be most appropriate. The surge-meter for quantitative evaluation of average amplitude of acceleration variation or torque variation was developed.

48827 **APTIC NO. 71461**

Nekrich, Y. M., N. I. Pevnyy, L. N. Glekova and N. G. Grebinichenko

CATALYTIC REDUCTION OF NITROGEN OXIDES IN LOW-CONCENTRATION GASEOUS MIXTURES. *(Kataliticheskoye vosstanovleniye okislov azota v slabokontsentrirovannykh gazovykh smesyakh). Text in Russian. Khim. Tekhnol., no. 5:38-39, 1974. 9 refs.*

The efficiency of different metallic catalysts in the reduction of mixtures containing 0.01-0.1% nitric oxide plus nitrogen dioxide in the presence of hydrogen and carbon monoxide as reducing agents was studied in a temperature range of 150-350 C under laboratory conditions. The catalysts were used in the form of grains 1-3 mm in size. A ruthenium catalyst showed an efficiency of 98% in a concentration range of 0.01-0.03% NO2 at 280-300 C. Iron-chromium and zinc-chromium-copper catalysts had an efficiency of 98-99% at 280-300 C. Zinc chromium catalysts were highly effective in the removal of NO, while copper- containing catalysts were less suited for reduction in the presence of free oxygen. A small quantity of iron oxides as obtained from native iron ores facilitated the reduction of nitrogen oxides by CO.

48828 **APTIC NO. 70423**

Newby, R. A., D. L Keairns, and E. J. Vidt

RESIDUAL OIL GASIFICATION/DESULFURIZATION AT ATMOSPHERIC PRESSURE - CLEAN POWER FROM EXISTING BOILERS. *Preprint, American Inst. of Chemical Engineers, New York, 30p., 1974. 9 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 67th, Washington, D. C., Dec. 1-5, 1974.)*

An atmospheric pressure fluidized bed oil gasification process is described which uses high sulfur atmospheric and vacuum bottoms fuel oils. The chemically active fluidized bed (CAFB) process generates a clean, low heating value, fuel gas at 870 C and 7450 kJ/cu m for firing in a conventional power plant. Batch tests and pilot plant runs demonstrate a removal of 90% S, 100% fuel vanadium, 75% nickel, and 40% sodium. Nitrogen oxides emissions are reduced, solid waste is in a dry form and may be reduced in quantity compared to slurry scrubbing systems. Total energy cost for CARFB is comparable to or lower than limestone slurry, lime scrubbing, or hydrodesulfurization fuel adder cost, depending on residual fuel oil costs and availability and on maintenance costs. The capital investment for CAFB and limestone or lime slurry scrubbing processes is comparable at $40 to $50/kw for a 200 MW retrofit. (Author summary modified)

48829 **APTIC NO. 70906**

Nichols, Grady B.

THEORETICAL AND PRACTICAL ASPECTS OF FINE PARTICLE COLLECTION BY ELECTROSTATIC PRECIPITATORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine- Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 137-168. 6 refs. (Jan. 15-18, Paper 7.)*

The fractional collection efficiencies of three electrostatic precipitators (two full-size and one pilot-scale) installed at different coal-fired power plants were measured to compare theoretical values with those achieved in practice. The collection efficiencies ranged from a minimum of about 80% for particle diameters of 1.2 micron to a maximim of about 99.8% for 0.06 micron particle diameters in precipitators of moderate size operating at relatively low current density. Measured collection efficiencies for particles larger than 1.0 micron in diameter were considerably lower than those predicted from theory, presumably because of particle reentrainment. Overall, the precipitators appeared to be efficient collectors of fine particles (less than 2 micron) as predicted by theory. (Author summary modified)

48830 **APTIC NO. 71480**

Niepenberg, H. P.

DEVELOPMENT TRENDS OF BURNER DESIGN FOR LIQUID AND GASEOUS FUELS. *(Entwicklungstendenzen im Grossbrennerbau fuer fluessige und gasfoermige Brennstoffe). Text in German. VGB Kraftwerkstechnik, 54(11):731-736, 1974.*

Burners for the combustion of liquid and gaseous fuels have reached a high technical level. They permit operation with low excess air both with fuel oil and with gas. As a consequence of the near stoichiometric combustion the carbon monoxide and particulate concentrations in the flue gas are low. Stability and combustion of the flame are good over the entire load range. A description of the most frequently used burners is given.

48831 **APTIC NO. 71346**

Nishikawa, Kazuyuki, Shigeru Ito, Tsutomu Shibata, and Hiroshi Suzuki

ODORS EXHAUSTED IN FOUNDRY AND ITS CONTROL. *(Chuzo kojo no akushu to sono shori). Text in Japanese. Imono (Foundry), 46(8): 715, Aug. 1974.*

Odors associated with foundries were studied for their origin and to design deodorization techniques. Strong odors appeared during molding processes, originating from organic additives of coal products and plant extractant additives mixed with crude sand upon heating. Phenol, formaldehyde, ethylene, toluene, xylene, and styrene were identified as the odor components. Deodorization was achieved by mixing an oxidizing agent into an absorption liquid, thus oxidizing organic odor components. The technique removed more than 90% of the phenol and reduced other odors also; the odor unit value at the inlet of the absorption tower was greater than 2000 and that at the outlet was below 100.

48832 **APTIC NO. 70412**

Noer, J. A., K. W. Malki, and D. O. Swenson

RESULTS OF A PROTOTYPE SCRUBBER PROGRAM FOR THE SHERBURNE COUNTY GENERATING PLANT. *Preprint, Inst. of Electrical and Electronics Engineers, New York; American Society of Mechanical Engineers, New York; and American Society of Chemical Engineers, Washington, D. C., 7p., 1974. 9 refs. (Presented at the IEEE (Institute of Electrical and Electronics Engineers)/American Society of Mechanical Engineers/American Society of Chemical Engineers Joint Power Generation Conference, Miami Beach, Fla., Sept. 15-19, 1974.)*

A prototype test program for 99% removal of particulate matter and 50% removal of sulfur dioxide from stack gases at a power generating plant is described. The two units of the 1360-Mw plant are scheduled to operate commercially in 1976 and 1977. Low-sulfur western coal will be the fuel. The limestone two- stage wet scrubber was installed at an existing plant using low- sulfur western coal to simulate the two unit power plant conditions. Increasing the limestone feed rate in the one-stage system increased the SO2 removal efficiency up to a point. Beyond this point, increased limestone feed rates had a decreasing effect on SO2 removal efficiency. The calcium in the fly ash played a major part in the removal of SO2, representing 70-80% of the system total additive requirements. High solids in the spray slurry were required to operate free of calcium sulfate scaling. The one-stage scrubber system produced outlet particulate matter loadings in excess of the requirements. The two-stage system achieved the required outlet particulate loading of 0.04 gr/SCF. Three to four times the stoichiometric air was required to complete oxidation of sulfite to sulfate in the reaction tank while scrubbing flue gases from low-sulfur western coals. A demonstration test of 50 continuous days was completed with 99% availability of the two-stage scrubber system. (Author conclusions modified)

48833 **APTIC NO. 71300**

Nohira, Hidetaka and Kazuo Tomita

DEVICE FOR DISPOSAL OF LIQUID OF CONDENSATION IN EXHAUST GASES. *Toyota Jidosha Kogyo Kabushiki Kaisha, Aichi-ken (Japan)) U. S. Pat. 3,817,221. 4p., June 18, 1974. 3 refs. (Appl. April 17, 1972, 2 claims).*

An improved exhaust gas recirculation system is described that provides for the removal of liquid condensate from exhaust gases of internal combustion engines, thus precluding corrosion of various recirculation system components. The improvement consists of a trap mounted in the exhaust gas passageway for the collection of condensate and conduit system for connecting the trap to a suction system of the engine. The liquid is recirculated to the combustion chamber by the negative suction pressure of the internal combustion engine.

48834 **APTIC NO. 71406**

O Dell, Leonard J.

FILTER ARRANGEMENT. *(American Air Filter Co., Inc., Louisville, Ky.) U. S. Pat. 3,816,978. 8p., June 18, 1974. 6 refs. (Appl. Oct. 18, 1971, 10 claims).*

An apparatus for filtering particulate matter from extremely long filter element tubes is described. It is efficient, inexpensive, and does not require complicated valving and gas bypass arrangements. It cleans the filter surface of a gas- permeable tubular fabric filter without the use of a complicated shaker mechanism or without the multiplicity of air jets to direct a stream of high velocity gas normal to the filter surface. No other filtering apparatus can efficiently clean extremely long tubular elements. They are rapidly becoming standard in the industry now that greater emphasis is placed on environmental pollution control.

48835 **APTIC NO. 71021**

Okamura, M., Y. Tanaka, and N. Yoshino

STUDY ON THE DELAY OF THE INJECTION TIMING OF DIESEL MOTORCAR. *(Dezeru-sha no funsha jiki chien ni kansuru chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):479, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th Chiba, Japan, Nov. 6-8, 1974, Paper 327.)*

The effect of injection timing delay on reducing nitrogen oxides emissions from diesel engines and on the variation in engine functions was investigated. The NOx, hydrocarbons, and smoke denisty were measured by delaying injection timing 3, 5, and 7 deg (crank angle). The estimated total emission quantity of NOx in Tokyo for 1975 is 81,000 for all mobile emission sources and 8019 tons/year for diesel engines, and estimated reduction quantities are 1530, 2250 and 2970 tons/year 3,5, and 7 deg delay, respectively. The correseponding reduction rates for diesel engines are 19, 28, and 37% at 3,5, and 7 deg respectively. The HC emission varied little with a 3-5 deg delay; however, it increased slightly with a 7-degree delay. The engine functions (output, torque, and exhaust temperature) deteriorated with the increase in delay angle; however, the fuel consumption varied little. The NOx and HC emission quantities increased with an increase in load. The smoke density showed a slight decrease with a 3-degree delay, though it varied greatly with engine types.

48836 **APTIC NO. 71279**

Hollinden, Gerald A. and H. W. Elder

WORLDWIDE REVIEW OF MAJOR SULFUR DIOXIDE REMOVAL PROCESSES APPLICABLE TO COAL-FIRED UTILITY BOILERS. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 55-63. (Oct. 22-24.)*

A review of major sulfur dioxide removal processes applicable to coal-fired utility boilers is presented. Lime-limestone scrubbing is the leading method in the United States and accounts for some 70% of the total planned flue gas desulfurization facilities. Magnesium scrubbing is the leading recovery process, with three plants in operation and others planned. Problems encountered with lime-limestone scrubbing systems include: chemical scale and mud-type deposits in the scrubbing system, reheater corrosion, and solid waste disposal. Magnesium scrubbing involves separation, regeneration, and recycling of large quantities of solid materials, and the stability of these materials needs further evaluation. The capability of sulfuric acid and sulfur markets to absorb products from recovery processes needs to be established. Double alkali type processes (clear liquor scrubbing with an alkali or other absorbent followed by sulfite- sulfate precipitation with lime or limestone) appear to be much more popular in Japan than in the United States. Lime-limestone slurry scrubbing, however, is still the most popular process in Japan.

48837 **APTIC NO. 70701**

Onishi, Shigeru, Saburo Yui, and Katsuji Shoda

TWO CYCLE STRATIFIED GAS ENGINE. *(Nisaikurushiki sojo kyuki kikan). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-43738. 8p., Nov. 22, 1974. (Appl. Oct. 26, 1970, 3 claims).*

Uniform combustion by eliminating misfiring during the idling, improvement in the fuel consumption ratio, and reductions in air pollutant emissions were accomplished by the use of a separate charging port for idling and stratified charging. In the two-cycle engine with a piston, the exhaust and charging port were controlled by piston movement and spark ignition located at the cylinder head, the charging port was closed during the idling by means of flow control valve. The chaging port for idling which opens at bottom dead point was located at the opposite side of exhaust port. During idling, the mixed gas charged from the idling charging port was stratified near the top dead point of piston. The mixed gas flow from the idling charging port was controlled by the flow regulator. Multiple numbers of idling charging ports may be placed at corresponding positions, forming the mass of mixed gas which is stratified in the cylinder head near the top dead point.

48838 **APTIC NO. 71305**

Osaki, T. and K. Fukunaga

MANUFACTURING METHOD FOR ACTIVATED CARBON FOE DESULFURIZATION OF STACK GAS. *(Haien datsuryu yo kasseitan no seiho). Text in Japanese. (Kurare Chemical Co., Ltd., Okayama (Japan)) Japan. Pat. Sho 49-45158. 2p., Dec. 2, 1974. (Appl. July 27, 1970, 1 claim).*

Coffee bean residue was used as raw material for manufacturing activated carbon which has high sulfur dioxide adsorption capacity. When coffee is extracted from the bean, such as in the manufacture of instant coffee, alkali metal salts and alkaline earth metal salts are extracted at the same time. The residue thus becomes ideally suited for use as raw material in the manufacture of activated carbon to be used in desulfurization of stack gas. Availability of large amounts of material at low cost is another advantage. Coffee bean residue, containing less than 10%, in the ash, of alkali metal oxides and alkaline earth metal oxides, was dried at 850 C, then pulverized. Pitch was added, and granules, 7 mm in size, were formed. Low-boiling components of pitch were removed by dry distillation at 850 C. Activation with steam produced active carbon of 25-29% adsorption capacity toward SO2.

48839 **APTIC NO. 71428**

Peters, Werner

COAL AS CRUDE MATERIAL AND ENERGY CARRIER. *(Kohle als Rohstoff und Energietraeger). Text in German. Erdoel Kohle - Erdgas - Petrochem., 27(11):695-700, Nov. 1974.*

The fundamentals of the industrial processes for coal liquefaction and gasification are considered. By hydrogenating coal it is possible to produce heavy oil for use in power stations economically, but not petroleum for carburetor engines. In production of synthetic gas from coal, the use of process heat from nuclear reactors will be of great importance. In the long run it will be necessary to import coal, even with optimal use of indigenous resources.

48840 **APTIC NO. 70447**

Pohlenz, J. B.

THE SHELL FLUE GAS DESULFURIZATION PROCESS. *Preprint, Environmental Protection Agency, Washington, D. C., 28p., 1974. 6 refs. (Presented at the Flue Gas Desulfurization Symposium, Atlanta, Ga., Nov. 4-7, 1974.)*

The development and application of the flue gas desulfurization process of Shell International Petroleum are described. The process uses a dry acceptor, copper oxide on alumina in a fixed, packed bed to extract sulfur oxides from flue gas containing oxygen and particulate matter. As the acceptor becomes loaded with sulfur, the desulfurization efficiency decreases, and the material is regenerated in-situ and at the same temperature to release the sulfur as sulfur dioxide in the regeneration off gas. Two or more identical reactors are applied in swing operation to provide for continuous processing of flue gas. The SO2 in the off gas from regeneration, free from O2 and particulate matter, can be processed to yield liquid SO2 or elemental S.

48841 **APTIC NO. 70977**

Prince, Martin, Hillard Blanck, and Gregorio Tarancon

REMOVAL OF PARTICULATE MATTER FROM GASEOUS WASTES BY WET COLLECTORS. *(Saleen Development Corp., New York) U. S. Pat. 3,814,615. 8p., June 4, 1974. 3 refs. (Appl. April 26, 1972, 12 claims).*

A scrubbing additive for increasing particle collection efficiency of wet collection devices, particularly venturi scrubbers, is described. The scrubbing liquid consists of a mixture of the following additives in water: an alkylphenyl polyethoxy alcohol, an N-substituted ethoxy amide of a fatty acid, an ethoxylated fatty alcohol, and one or more starches. The ethoxylated fatty alcohol comprises from 0.5-40 wt% of the mixture, while the alkylphenyl polyethoxy alcohol and the N-substituted ethoxy amide of a fatty acid are present in approximately equal molar amounts of at least 35 wt%. The proportion of starch, preferably tapioca starch, is in the range of 50-1000 ppm. The addition of a salt such as sodium chloride, calcium chloride, potassium thiocyanate, sodium sulfate, or sodium sulfite in the same proportion as that of the starch enhances the mixture's effectiveness.

48842 **APTIC NO. 70911**

Raben, Irwin A.

USE OF SCRUBBERS FOR CONTROL OF EMISSIONS FROM POWER BOILERS - U. S. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 267-316. 7 refs. (Jan. 15-18, Paper 13.)*

Various pilot and commercial scrubber systems for the removal of particulates from coal-fired power plant boilers are described. There are presently 23 full-size scrubbing systems which are being engineered, constructed, or operated in the United States for particulate control. Scrubbers most frequently installed are the venturi, turbulent contact absorber, and the marble-bed unit. Collection efficiencies of over 99% are being achieved, though removal efficiency drops rapidly with decreasing particle size and pressure drop. Tests at one pilot plant indicate that for submicron particles (0.11-0.99 micron) efficiencies of 95-99% are attainable at 9.8 in. water total pressure drop. At 5.6 in. H2O, the efficiency falls to the 71-90% range. Experience with particulate control by water scrubbing indicates that sulfur dioxide must also be removed since it affects liquor chemistry, pH, scaling, and reliability. New systems are being designed for higher liquid to gas ratios, higher percent solids in the circulating liquid, longer residence time in the recirculating tank, and pH control.

48843 **APTIC NO. 71271**

Rawlings, Gary D., Hal B. H. Cooper, Jr., and J. Martin Hughes

AIR POLLUTION CONTROL AT COTTONSEED OIL MILLS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 148-158. 1 ref. (March 18-19.)*

Air pollution monitoring studies at cottonseed oil mills are reviewed. Cyclones handling cleaning operations involving lint cleaners and hull and seed separators are responsible for the majority of emissions (particulate) from such mills. Particle size distribution analysis indicates that over 90% of the particles emitted from cyclones are below 15 micron in diameter. This is effectively the cut-off collection efficiency limit for most dry cyclones. Cyclone modifications which can improve collection efficiency include: designing the cyclone inlet to be as long and narrow as possible, increasing the moisture content of the incoming material to the cyclone, and reducing the cyclone diameter. If such changes along with improvement in cyclone maintenance fail to result in compliance, secondary alternatives such as baghouses and wet scrubbers can be employed. Fugitive emissions from oil mills can be reduced by improved housekeeping and the use of partial covers with aspiration systems over seed dumping and meal and hull loading areas. Emission calculations indicate that an oil mill can be expected to produce 1.55 lb of particulate emissions per ton of seeds processed.

48844 **APTIC NO. 71067**

Regan, John William

REVERBERATORY FURNACE USING WASTE GAS FOR COMBUSTION. *(Combustion Engineering, Inc., Windsor, Conn.) U. S. Pat. 3,815,882. 5p., June 11, 1974. 5 refs. (Appl. Dec. 15, 1972, 7 claims).*

A reverberatory furnace which utilizes the heat from waste gases produced in a separate superherater is described. Unlike prior-art systems of similar nature, the present invention requires no costly air heaters and allows for simple and economical control of superheater steam outlet temperature. Excess air is employed in the combustion process within the superheater which generates auxiliary steam for the system. The exhaust gas from the superheater is passed directly into the reverberatory furnace for use in the combustion and reduction processes therein. The temperature of the superheated steam is controlled by regulating the amount of air supplied to the burners of the superheater. (Author abstract modified)

48845 **APTIC NO. 71074**

Rigo, H. Gregor

GASEOUS FLOW SEPARATOR AND HEAT EXCHANGER. *(Assignee not given.) U. S. Pat. 3,815,336. 7p., June 11, 1974. 14 refs. (Appl. Aug. 17, 1971, 9 claims).*

A particle collector-heat exchanger for removing both particulate material and heat from gas streams is described. The unit consists of several laterally spaced filter elements extending across the gas flow for entrapping particulate matter and conducting it downwardly out of the flow path. Heat exchange between the gas and the filter elements cools the gas. A cooling liquid may be used to provide cooling for the filter elements. Laterally disposed wings on the filter elements which define pockets for vortex formation entrap particulate material which then moves downwardly along the element. (Author abstract modified)

48846 **APTIC NO. 70852**

Rodgers, Larry W.

INTERACTIONS OF ELECTROSTATIC FIELD, FLOW, AND SURFACES IN PRECIPITATOR PASSAGES. *Illinois Div., Urbana, Dept. of Mechanical Engineering Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-5676, 1974, 128p. 49 refs.*

Experimental studies of the particulate flow through an electroaerodynamic, self-cleaning precipitator (electric wind in the same direction as the gas flow) were performed to determine scaling parameters and to improve the efficiency of a laboratory model through improved design. The effects of collection efficiency for various types and sizes of particles, plate conditioning, corona power, passage velocity, and corona wire-collector plate geometry were considered. These parameters were correlated with scaling parameters. The validity of the concept of electrohydrodynamic flow and surface interaction was demonstrated. Experimental results confirmed the predicted collection efficiency for small conducting particles and demonstrated a partial range of values for the sticking probability which ranged from 1 for cigarette smoke to less than 0.01 for fly ash. Two sticking coefficients were identified: a surface-particle interaction sticking probability and a particle-particle collection effectiveness coefficient to account for reentrainment. A sticking coefficient at the inlet was also identified which was a function of electric field, surface conditioning, and particle conductivity. A self-generated secondary field gave very high collection efficiency. The self-cleaning aspect of the precipitator resulted in an exponential increase in collection efficiency. The electroaerodynamic characteristics of the device resulted in low turbulence and thus low diffusivity which also improved collection.

48847 **APTIC NO. 70410**

Rosenberg, Harvey S., Richard B. Engdahl, Joseph H. Oxley, and Joseph M. Genco

STATUS OF SULFUR DIOXIDE CONTROL FOR FOSSIL FUEL COMBUSTION. *Preprint, American Inst. of Chemical Engineers, New York, 29p., 1974. 8 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 67th, Washington, D. C., Dec. 1-5, 1974, Paper 51c.)*

The results of demonstration plant inspections of most of the sulfur dioxide scrubbing installations in the U. S. are discussed. The purpose of the inspections was to establish a mechanism to collect installation and operating data, to analyze these data, and to distribute the resulting reports to management personnel concerned with the problem of SO2 in stack gas. Six processes have gained some degree of user acceptance in the U. S.: wet lime/limestone scrubbing, alkali scrubbing without regeneration, alkali scrubbing with calcium regeneration, alkali scrubbing with thermal regeneration, magnesium oxide scrubbing, and catalytic oxidation. The main remaining problem associated with SO2 scrubbing systems is the demonstration of continuous, long-term reliability. The Paddy s Run lime scrubbing facility comes closest to meeting the goal of satisfactory operation on a 100 MW or larger unit for more than 1 yr,. although the facility was only 65 MW. Although the time of continuous operation has been considerably less than 1 yr, Paddy s Run probably could be operated continuously for 1 yr at over 90% availability with carbide lime. However, because of the limited availability of carbide lime sludge, it is highly desirable that a facility similar to Paddy s Run be operated on conventional grades of hydrated lime to prove that other types of lime are also feasible. Other important unsolved problems of stack gas cleaning are stack gas reheating, sludge disposal for throwaway systems, marketing of by-products for recovery systems, and availability of appropriate grades of lime and limestone. The environmental effects of sludge disposal have yet to be resolved. (Author conclusions modified)

48848 **APTIC NO. 71490**

Rychlik, Frank J.

VALVING FOR INTERNAL COMBUSTION ENGINE. *(Assignee not given.) U. S. Pat. 3,821,941. 5p., July 2, 1974. 7 refs. (Appl. Jan. 2, 1973, 6 claims).*

A modified two-cycle stratified charge engine that achieves significant reductions in hydrocarbon emissions is described that utilizes a unique valve arrangement in the cylinder head to induce a swirling-type fuel-air mixture into the cylinder. The induction of air in this manner compresses the exhaust gases downwardly from the top of the engine cylinder and out the exhaust port or ports, thus resulting in the trapping of a larger portion of the incoming fuel-air mixture and less loss through the exhaust port. The valves are pressure-actuated and magnetically biased toward a closed position. The engine can operate with equal efficiency and without knock over a wide range of octane rated fuels.

48849 **APTIC NO. 71311**

Saita, Toshikazu and Yoshimasa Sato

ENGINE IGNITION APPARATUS. *(Kikan tenka sochi). Text in Japanese. (Mitsubishi Electric Appliances Co., Ltd., Tokyo (Japan)) Japan. Pat. Sho 49-46010. 3p., Dec. 7, 1974. (Appl. Aug. 31, 1970, 1 claim).*

A delayed action ignition mechanism is used in conjunction with ignition signals arising from engine revolution. Delayed engine ignition is controlled by the sum of the time-lags of independently acting multiple delay circuits. The ignition spark is produced at the most appropriate ignition time for the engine.

48850 **APTIC NO. 71313**

Saita, Toshikazu

IGNITION TIME CONTROL APPARATUS FOR ENGINES. *(Kikan tenka jiki chosei sochi). Text in Japanese. (Mitsubishi Electric Appliances Co., Ltd., Tokyo (Japan)) Japan. Pat. Sho 49-46011. 2p., Dec. 7, 1974. (Appl. Sept. 10, 1970, 1 claim).*

A device using engine ignition timing regulation as a means of exhaust gas purification, is described. Negative air-intake tube pressure is transferred to a pair of vacuum chambers, connected by a tube which is highly resistant to air flow, and separated by a diaphragm which ultimately operates a solenoid. By utilizing the pressure difference in the two vacuum chambers, the state of acceleration of the engine is determined, and engine ignition time is regulated accordingly.

48851 **APTIC NO. 71017**

Sakata, Hatsuzo

RESEARCH ON THE GAS PURIFICATION IV: REMOVAL OF CARBON MONOXIDE FROM GAS BY NICKEL FERRITE. *(Gasu no seisei kenkyu dai 4-ho: nikkeru feraito ni yoru gasuchu no issanka tanso no jokyo). Text in Japanese. Nagaoka Kogyo Koto Senmon Gakko Kenkyu Kiyo (Res. Rep. Nagaoka Tech. Coll.), 10(3-4):43-53, Dec. 1974. 5 refs.*

Nickel ferrite used as a catalyst to remove carbon monoxide gas is studied. The nickel ferrite preparation method is included. An excellent chemical absorption ability of nickel ferrite was obtained when the compound was baked at 400 C. After placing the baked nickel ferrite in a reaction tube, the CO removal efficiency is tested and compared under different experimental conditions. With a range of reaction temperature consisting of 100-500 C, the CO concentration 0.25-9%, and the gas space velocity 1000-9000 ml/hr, the efficiency depended only on the reaction temperature. The highest CO removal efficiency, 99.9%, was obtained at 400 C. When the catalyst is used for automobile CO emission control, good efficiency would be expected at running condition, but the efficiency would be lower during idling because of the lower gas temperature and higher CO concentration. The mechanism of nickel ferrite as an absorbent for CO is considered in both physical and chemical applications, as well as during catalytic oxidation. Of these, both the formation of addition compounds from the original two compounds, and the oxidation of CO to carbon dioxide by nickel ferrite are the major mechanisms. If nickel ferrite acts purely as an oxidation catalyst, the regeneration of the catalyst is easily achieved by heating in air at 300 C. However, if the formation of addition compounds is involved, the regeneration of nickel ferrite is difficult even if it is heated at 1000 C; the CO absorbing ability by the regenerated nickel ferrite decreased to less than half of that achieved by the fresh nickel ferrite.

48852 **APTIC NO. 71282**

Saleem, A.

COMMERCIAL SO2 REMOVAL AT DETROIT EDISON USING LIMESTONE IN A HIGH VELOCITY SPRAY TOWER. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 81-86. 1 ref. (Oct. 22-24.)*

Pilot and full-scale installations of limestone scrubbing equipment for the removal of sulfur dixoide from steam plant stack gases are described. Initial pilot plant tests on a 1 MW electrical generating unit revealed scaling and plugging problems whcih were subsequently corrected by the installation of high velocity countercurrent spray tower, larger recycle tanks and pumps, an automatic pH control system, a slurry density control, and a wash tray. Installation of the limestone scrubbing system on a 175 MW coal-fired boiler resulted in an SO2 removal efficiency of 90% for an inlet SO2 rate of 10,600 lb/hr. Particulates in the flue gases were reduced from 18,048 lb/hr to 48 lb/hr.

48853 **APTIC NO. 71397**

Santos, Anthony R., Ontario R. Santos, and Gerald Dean Allen

DEVICE FOR REMOVING NOXIOUS MATTER FROM EXHAUST GASES. *(Assignee not given.) U. S. Pat. 3,824,769. 7p., July 23, 1974. 6 refs. (Appl. Oct. 10, 1972, 1 claim).*

A practical device for removing noxious matter from exhaust gases generated through a burning of organic materials is described. The device consists of a tubular chamber which receives the exhaust gas, a water bath for washing and cooling the gas, and a circulating system including a sump located beneath the chamber for collecting granulated water and a circuit for returning water from the sump to the water bath. The operation of the device is simple, economical, and practical. Other devices are not as economically feasible and normally require substantial maintenance. (Author abstract modified)

48854 **APTIC NO. 71469**

Sasaki, Kenichi, Masatsugu Shiobara, and Masao Nakajima

IGNITION TIME CONTROL APPARATUS. *(Tenka jiki seigyo sochi). Text in Japanese. (Nissan Jidosha KK (Nissan Motors, Ltd.), Yokohama (Japan)) Japan. Pat. Sho 49-46009. 7p., Dec. 7, 1974. 2 refs. (Appl. April 1, 1970, 1 claim).*

Ignition timing control in automotive internal combustion engines is effected through the distributor by means of two diaphragms, housed in a case attached to the distributor, and acting according to negative engine pressures. Two diaphragms divide the diaphragm case into three compartments in line with each other. Diaphragm 1 moves in accordance with difference between atmospheric pressure in the first compartment and negative pressure in the second (center) compartment. Ignition time is advanced by action initiated by movement of Diaphragm 1. The third compartment is held at negative pressure, unless engine speed is decreased, or engine temperature is increased beyond predetermined values. Under such circumstances, an electromagnetic valve causes air at atmospheric pressure to enter the third compartment. The difference in

pressures between the third compartment and the second (center) compartment, causes Diaphragm 2 to change position, and retard ignition timing.

48855 **APTIC NO. 71416**

Sawada, Taku

AUTOMOTIVE EMISSION CONTROL APPARATUS FOR NITROGEN OXIDES. *(Jidosha yo chisso sankabutsu haishutsu yokusei sochi). Text in Japanese. (Nissan Jidosha, KK (Nissan Motors, Ltd.), Yokohama (Japan)) Japan. Pat. Sho-49-45642. 8p., Dec. 5, 1974. 2 refs. (Appl. Nov. 20, 1969, 2 claims).*

An arrangement for emission control of nitrogen oxides from automobile engines during acceleration only is described. Two valve seats are places within the valve housing when tubing for returning exhaust to the engine manifold or tubing for furnishing fresh air from the air cleaner to the engine manifold is attached to the automotive engine. By means of a spring arrangement, exhaust gas return or fresh air intake is stopped when negative air intake pressure is outside a given range (100-250 mm Hg). Emission of nitrogen oxides is reduced during times of acceleration (0-30 mph, 15-50 mph; intake pressure, 100-250 mm Hg), because introduction of exhaust return or fresh air intake decreases combustion temperature and reduces NOx formation. Engine malfunction during idling, cruising, or deceleration, when NOx emission is negligible, is minimized by not introducing exhaust return or fresh air intake into the system at pressures outside the range of 100-250 mm Hg.

48856 **APTIC NO. 70815**

Schowalter, K. A. and E. F. Petras

CLEAN-CHAR PROCESS. *Preprint, American Chemical Society, Washington, D. C., 18p., 1974. (Presented at the American Chemical Society, National Meeting, 167th, Los Angeles, Calif., March 31-April 5, 1974.)*

The Clean-Coke Process was developed by U. S. Steel which has economic and ecological advantages over the coke oven method of producing coke. The Clean-Coke process provides for obtaining about 34% of the coal fed to the process as metallurgical coke pellets, considered to be worth about $35-40/ton, or $1.40-1.60/ million Btu. The removal of this amount of high-carbon-containing product then results in a much more favorable hydrogen-to-carbon ratio in the remaining material, such that about 18% of the coal is recovered as chemical feedstocks valued at $120/ton. The Process is most simply characterized as a unique combination of low-temperature carbonization and hydrogenation processes, integrated in a manner that permits optimum utilization of energy and materials. The objective of the current Clean-Coke Program is to develop design information for a pilot plant that will process up to 10 tons of coal/hr. The carbonization-desulfurization portion of the process converts 2% sulfur coal into char containing 0.4-0.6% sulfur. Thus the operation can be used for production of an ecologically acceptable boiler fuel. This approach, called the Clean-Char Process, was further studied for technical and economical feasibility. Total fixed investment, including battery limits, utilities, offsites, and construction loan interest for a Clean-Char plant to supply a 1000 megawatt power plant with a 60% load factor is $90.3 million. The addition of $5.6 million working capital results in a total capital investment of 95.9 million. By-product credits of $10.3 million reduce annual operating expenses to $27.86 million. The total fuel cost would be $0.63/MM Btu.

48857 **APTIC NO. 71378**

Schwab, Louis

ELECTROSTATIC GAS FILTERS. *(Assignee not given.) U. S. Pat. 3,816,980. 5p., June 18, 1974. 20 refs. (Appl. March 21, 1972, 5 claims).*

An electrostatic gas filter element for use in a gas filter is described. It is an improvement over a similar filter element in that it contains three, rather than two, planar electrodes spaced in substantially parallel planes along the direction of the gas flow. The three electrodes generate much more complex electrostatic fields. The electrodes are less expensive than previously used electrodes, but still produce more complex and irregular voltage gradients to enhance agglomeration of sub-micron particles and to reduce smoke and odors.

48858 **APTIC NO. 70809**

Schwartz, W. A., F. B. Higgins, Jr., J. A. Lee, R. Newirth, and J. W. Pervier

ENGINEERING AND COST STUDY OF AIR POLLUTION CONTROL FOR THE PETROCHEMICAL INDUSTRY VOLUME I: CARBON BLACK MANUFACTURE BY THE FURNACE PROCESS (FINAL REPORT). *Air Products and Chemicals, Inc., Marcus Hook, Pa., Houdry Div., Office of Air and Water Programs Contract 68-02-0255, Rept. EPA-450/3-73-006-a, 127p., June 1974. 22 refs.*

NTIS: PB 238324/AS

The manufacture of carbon black by the furnace process was investigated to determine the extent of air pollution. The stack exhaust from furnace black plants are typically invisible, and efficiencies of particulate removal exceed 99%. Carbon monoxide is emitted at a rate equal to 1.3 lbs/lb of carbon black produced. The process also emits hydrogen sulfide and mercaptans if the CO is not further oxidized or oxides of sulfur if a combustion step is included. Oxides of nitrogen are also emitted. Bag filters are the best techniques for control of particulate emissions from the main process vent. Off-gas combustion is the only demonstrated technique for the control of emissions of reduced sulfur compounds and/or CO. By 1985 the carbon black industry will emit nearly 7 billion lbs of pollutants/yr unless plume burners are installed on all existing plants and efficient offgas combustion devices are installed on all new plants. The new plant emission factors can be about 0.004 lb NOx/lb of carbon black and 0.03 lb of SOx/lb of carbon black with only traces of hydrocarbons, particulates, and CO emitted if a CO boiler or its equivalent are installed. (Author summary modified)

48859 **APTIC NO. 70923**

Scott, David S.

ADVANCES IN THE SONIC AGGLOMERATION OF INDUSTRIAL AEROSOL EMISSIONS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 597-624. 8 refs. (Jan. 15-18, Paper 25.)*

A resonant pulse-jet sonic aerosol agglomerator was investigated in both a valved combustion chamber configuration and a no-moving-parts combustion chamber using aerodynamic valving. The waveform, although rough, contained the basic saw-tooth features desired for enhancement of particle-particle collision frequency. There was a direct conversion of fuel energy to acoustic energy, implying the potential for a particulate collector of relatively high overall efficiency. The capital costs of the equipment was very low, especially in comparison with previous acoustic agglomerators. The system appears to be both useful and economically feasible for certain dust control situations.

48860 **APTIC NO. 71289**

Selmeczi, Joseph G. and Hameed A. Elnaggar

PROPERTIES AND STABILIZATION OF SO2 SCRUBBING SLUDGES. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 182-197. 3 refs. (Oct. 22-24.)*

Physical and chemical properties of sludges generated from sulfur dioxide scrubbing are discussed in relation to their use as landfill. Such sludges may contain fly ash, sulfites, sulfates, gypsum, dolomite, and lime. Particle size falls in the range of silt, with minor percentages in the fine sand and clay size particles. The physical and chemical characteristics of the scrubbing sludges vary depending on the fly ash and sulfur dioxide content of off-gas treated, the type of scrubbing reagent used, and the process chemistry. It is possible to harden sludges by mixing them with additives to achieve a strength comparable with that of dense granular soils and over-consolidated clays. The strength of the treated sludges increases with increased initial solid content, increased percent additive, increased curing time, and increased temperature. The void ratio- consolidation stress relation is similar to that of clays but with a pre-consolidation stress of about 10 tons/sq ft. The permeability of sludges decreases with increasing initial solid content and increasing percent additive. The disposal of treated sludges as landfill is possible, and such disposal sites can ultimately be used in land development.

48861 **APTIC NO. 70857**

Semrau, Konrad and Clyde L. Witham

WET SCRUBBER LIQUID UTILIZATION (FINAL REPORT). *Stanford Research Inst., Menlo Park, Calif., Environmental Protection Agency Contract 68-02-1079, ROAP 21ADJ-005, Program Element 1ABO12, Rept. EPA-650/2-74-108, 126p., Oct. 1974. 39 refs.*

NTIS: PB 23749/AS

The effects of energy consumption, liquid-to-gas ratio, and condensation of water vapor on the collection efficiency of a conventional cocurrent-contact particulate scrubber of the orifice type was investigated in bench-scale studies. The test aerosol was composed of spherical particles of ammonium fluorescein with a mass-median diameter of approximately 0.5 micron. The collection efficiency of the scrubber was determined and correlated as a function of the effective friction loss across the scrubber. In the absence of condensation or evaporation effects, the scrubber efficiency was dependent only upon effective friction loss, with no independent influences of gas velocity, liquid-to-gas ratio, or contactor orifice size, except possibly in the range of very low gas velocities, liquid-to-gas ratios, and pressure drops. Evaporation of large amounts of water reduced collection efficiencies, but scrubbing hot, humid gas with cold water to produce condensation significantly increased the collection efficiency. The most favorable results were obtained by presaturating the hot, humid gas stream before contacting it with cold water. (Author abstract modified)

48862 **APTIC NO. 71281**

Sheehan, J. D., J. S. Hayford, J. C. Orcutt, and L. V. Van Brocklin

PHOSPHATE PROCESS FOR THE DESULFURIZATION OF POWER PLANT FLUE GASES. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 70-79. (Oct. 22-24.)*

A wet scrubbing technique for the desulfurization of power plant flue gases known as the Phosphate Process is described along with pilot and full-scale field test results. Aqueous sodium phosphate buffer solution is used as an effective absorbent for sulfur dioxide. The absorbed SO2 is then reacted with hydrogen sulfide for the recovery of elemental sulfur. Pilot scale studies on a Claus plant demonstrated SO2 reductions of from 12,000 ppm (pretreatment level) to 100 ppm (post-treatment level). Sulfur dioxide reductions from 25,000-3000 ppm to less than 50 ppm are being attained at a full-scale steam electric plant installation. Capital cost of the system is estimated at $32-35/KW. Operating costs are approximately 1.6 mills/kWh or about 7-8% of the average cost of electricity delivered to the consumer.

48863 **APTIC NO. 70548**

Shigeta, Yoshitsugu and Kozo Higuchi

DESULFURIZATION INSTALLATION FOR DIGESTING GASES FROM HUMAN WASTE TREATMENT. *(Shinyo shori ni yoru shoka gasu no datsuryu sochi). Text in Japanese. (Kyoei Koji KK, Kawasaki City (Japan) and Hokutan Kasei Kogyo KK, Toda City (Japan)) Japan. Pat. Sho 49-36341. 3p., Oct. 3, 1974. (Appl. April 2, 1970).*

A desulfurization installation is described for removal of sulfur from digesting gases (mostly methane) which result from human waste treatment. Two desulfurization-deodorization tanks, operated alternately at 15-day intervals, are connected to the digestion tank from which the gases emanate. The cyclindrical desulfurization tanks are fitted at the bottom with a conical funnel-sieve with narrow slits cut parallel to the circumference. This funnel is packed with spheroidal desulfurization agent The bottom section of the tanks, including the funnel, and the lining of the tanks, are made of polyvinyl chloride. Untreated gases are introduced into the desulfurization tanks in the space between the funnel wall and tank wall in the bottom section of the tanks. Gases pass through the slits and through the treating material, and are piped out at the top to a storage tank. Suitable openings and connections at the top, bottom, and side of the tanks facilitate addition, regeneration, and removal of desulfurization agent. The slits and the conical packing allow more surface area of the desulfurization agent to be in contact with the untreated gases.

48864 **APTIC NO. 71412**

Shimoi, Yoichi, Masayuki Kiuchi, and Yutaka Takeda

TURRET---ACIDIC GAS ABSORPTION BY WATER. *(Teraretto---Mizu ni yoru sansei gasu no kyushu). Text in Japanese. Kagaku Kojo (Chem. Factory), 18(11):49-55, Nov. 1974. 16 refs.*

The of acidic gas by water is one of the most basic forms of gas absorption, and can be handled by physical absorption theory. Some calculation examples made to obtain data for designing a packed tower using S and L type turrets for the absorption of sulfur dioxide, hydrogen chloride, hydrogen cyanide, and hydrogen fluoride by water are shown. In an SO2-air- H2O system, the Whitney s equation constant, liquid-gas equilibrium and turret pressure loss under a given set of conditions were calculated. In the case of HCl-air-H2O system, the calculations for tower diameter, packed tower height, and pressure loss to attain certain absorption rates are shown. In the case of phosphorus ore treatment as an example of the the HF-air-H20 system, the silicon tetrafluoride partial pressure over hydrofluosilicic acid solution, H2F2-SiF4-H2O phase composition and HF-H2O equilibrium were calculated. Similar calculations were also made for an HCN-air-H2O system. The effects of fume on absorption, particularly in the case of acidic gases such as sulfur trioxide, HCl, and chloric acid are discussed.

48865 **APTIC NO. 71321**

Shitazu, Futoshi

VARIABLE CRANK APPARATUS. *(Kahen kuranku sochi). Text in Japanese. (Assignee not given.) Japan. Pat. Sho 49-49321. 4p., Dec. 26, 1974. 3 refs. (Appl. Oct. 2, 1969, 1 claim).*

Improvements of engine cranks feature freely adjustable crank arms and internal shafts which rotate in the opposite way to their exterior shafts, arms, and pins. The internal shafts in the crank shafts, the crank arms and the crank pins are connected by bevel gears and rotate dependently in the opposite way. The crank arms are connected to the pistons in the engine cylinder through a connecting rod to control the movement of the piston and to give a high efficiency, low pollution engine.

48866 **APTIC NO. 71236**

Smith, Warren M.

FLUE GAS DESULFURIZATION USING SURFACE IMPREGNATED SORBENT. (Esso Research and Engineering Co.) U. S. Pat. 3,816,597. 6p., June 11, 1974. 3 refs. (Appl. Nov. 1, 1971, 4 claims).

An improved process for the desulfurization of flue gas is described. Sulfur dioxide is removed from flue gas by passing it through a fixed bed of sorbent consisting of copper oxide supported on alumina. The copper oxide is distributed predominantly in an outer layer of the alumina. This use of a surface coated rather than fully impregnated sorbent improves the utilization of the CuO, and makes this process more effective than other desulfurization processes. (Author abstract modified)

48867 **APTIC NO. 71301**

Staib, Estel G.

ATMOSPHERIC POLUTION CONTROL SYSTEM FOR AN INTERNAL COMBUSTION ENGINE. *(Head and Johnson, P.A., Tulsa, Okla.) U. S. Pat. 3,817,222. 5p., June 18, 1974. 7 refs. (Appl. Nov. 20, 1972, 4 claims).*

A pollution control device for absorption of solid and gaseous impurities from the exhausts of internal combustion engines is described that utilizes the engine s cooling liquid for the washing of exhaust components. The invention consists of a combustion muffler and radiator (heat exchanger) combined in one housing along with a Y-shaped conduit for the mixing of engine exhausts and cooling water. After the engine exhausts and cooling water (from the radiator return line) are combined in the Y-shaped conduit, the mixture is directed to a splash plate or diverter within the muffler on top of the radiator for intimate mixing of the gases and water. The exhaust gases are thus washed of all solid and gaseous pollutants prior to the release of the exhaust through a series of baffles for collection at the top of the radiator housing. The exhaust gases then pass through pipes to the atmosphere. The cooling liquid may be a combination of water and glycol-based antifreeze.

48868 **APTIC NO. 71297**

Steineke, Fredrik

METHOD OF RECOVERING FLUORINE FROM WASTE GASES. *(Elkem- Spigerverket A.S., Oslo (Norway)) U. S. Pat. 3,812,852. 3p., June 4, 1974. 3 refs. (Appl. March 19, 1973, 8 claims).*

A method for the economical adsorptive recovery of fluorine components from high temperature (500 C) gas streams is described that utilizes steam to increase the amount of fluorine chemically bound to an aluminum oxide adsorbent. The amount of steam added to the dry gas stream must be at least 0.5% by volume of the waste gases and is generally not more than 25% by volume. The steam can be added directly to the waste gases as a separate stream or it can be added to the waste gases in a fluidized bed reactor. Alternatively, the dry fluorine-containing gases can be mixed with gases having moist fluorine. The contact between the gas stream and the aluminum oxide adsorbent occurs at temperatures above the boiling point of the water in the particular contacting environment and below temperatures at which fluorine adsorbed by the aluminum oxide is liberated during the contact period.

48869 **APTIC NO. 71404**

Straitz, John F., III

FLARE STACK GAS BURNER. *(Combustion Unlimited, Inc., Elkins Park, Pa.) U. S. Pat. 3,824,073. 6p., July 16, 1974. 3 refs. (Appl. Aug. 13, 1973, 7 claims).*

A flare stack gas burner for burning combustible waste gas at low and high pressure from two separate gas delivery systems is described. It is highly effective because of enhanced air mixing and turbulence generation. Air at variable controlled low pressure is delivered into the stack at the bottom and moves upwardly between the vanes for smokeless burning. Optional fluidic seals can be provided in both the low and high pressure gas supply lines to prevent flashback. No other flare stack burners provide for smokeless burning of both high and low pressure gases by use of separate interengaged gas delivery systems with forced air combustion. (Author abstract modified)

48870 **APTIC NO. 71293**

Suda, Toshi, Tetsuji Akashi, and Hidetoshi Dohshita

FUEL INJECTION DEVICE FOR INTERNAL COMBUSTION ENGINES. *(Neppondenso Co., Ltd., Aichiken (Japan)) U. S. Pat. 3,815,564. 9p., June 11, 1974. 5 refs. (Appl. March 3, 1972, 10 claims).*

A timed fuel injection device for reducing exhaust emissions from internal combustion engines is described that overcomes prior-art limitations of injection systems utilizing only engine revolutions/min for fuel injection control. Electrical signals representing the revolutions/min, engine load, engine temperature, and acceleration of revolutions/min are detected with the present invention and introduced into a controller. The controller s output is used to actuate a servo motor or electromagnetic valve for controlling the time at which the fuel injection pump starts its operation.

48871 **APTIC NO. 71109**

Takahashi, Yasuro, Hisao Yamamoto, and Yukihisa Fujima

STUDY ON LOW NOX BURNER FOR GAS FUEL. *(Gasu daki chotei NOx bahna no kenkyu). Text in Japanese. Nihon Kikai Gakkai Shi (J. Japan Soc. Mech. Engrs.), 77(673):10-17, Dec. 1974. 9 refs.*

A preliminary comparative study on premix combustion and diffuse combustion indicated that the effect of air ratio and ratio of recirculated gas on nitrogen oxides formation was most prominent in the case of premix combustion. Using 2 tons/hr and 8 tons/hr furnaces, the characteristics of premix combustion were investigated by measuring nitric oxide, carbon monoxide, carbon dioxide, and oxygen concentrations in exhaust gas. In the uniform premix combustion, the formation characteristics of nitric oxide were investigated by varying the air ratio and the ratio of recirculated gas. The NO distribution in the direction of the flame was also measured. Based on experimental results, an engineering model of NO formation was developed, and the principle of a low NOx burner was established. For the reduction of NOx formation, the premix combustion burner is operated at high air ratio while cooling the flame temperature by some means, which can be achieved by a combination of burners, one for high fuel ratio gas (low air ratio) and others for low fuel ratio gas (high air ratio). Using the above-mentioned burner combination, a pilot low NOx burner was developed and tested, by which the NOx formation was reduced to less than 20 ppm.

48872 **APTIC NO. 71375**

Takahashi, Yasuro

LOW NOX BURNER OF MITSUBISHI HEAVY INDUSTRIAL CO. *(Mitsubishi jukogyo no tei NOx bana). Text in Japanese. Netsu Kanri To Kogai (Heat Management Public Nuisance), 26(12):37-39, Dec. 1974. 1 ref.*

Burners with pre-mixed flames are characteristically better than those with diffused flames. The burner described here uses a concentrated pre-mixed flame and a diluted pre-mixed flame with the total air ratio slightly higher than unity. A burner of this type was developed by dividing air paths into three chambers with air-fuel mixers in each chamber. Excess fuel was supplied to the middle chamber while excess air was supplied to the other two chambers. Results of application of the burner to two test furnaces with a capacity of million kcal/hr and 28 million kcal/hr, respectively, showed that nitrogen oxides were markedly reduced. The effect was more significant when up to 25% of the exhaust was recycled. Reduction of NOx to 20-30 ppm was possible.

48873 **APTIC NO. 70346**

Takayasu, Masami, Yoshiaki Annen, Kyoichi Kanzaki, and Yoshiro Morita

CATALYTIC REACTION OF NO (5). EFFECTS OF CO AND SO2 ON CATALYTIC OXIDATION. *(NO no sesshoku hanno (5). Sesshoku sanka ni okeru CO, SO2 no eikyo). Text in Japanese. Preprint, Japan Chemical Society, Sendai, P. 653, 1974. 1 ref. (Presented at the Japan Chemical Society, Fall Meeting, 31st Sendai, Japan, Oct. 2-5, 1974, Paper 2Q15.)*

Contact catalysis of nitric oxide on metal oxide catalysts was investigated. Most active catalysts were platinum, chromium, and cobalt. Inferior catalysts were copper, sulfates, and manganese/active carbon. Oxidation of carbon monoxide in the NO-CO-oxygen system reached 100% at temperatures near 200 C, on Pt and Co catalysts. However, NO-CO reaction proceeded at lower temperatures on Co than on Pt. In the presence of CO, oxidation of NO to nitrogen dioxide decreased on Pt catalysts, but increased on Co catalysts.

48874 **APTIC NO. 71496**

Tamaoki, Akiyoshi

THE STATUS QUO AND OUTLOOK OF HEAVY OIL DESULFURIZERS. *(Juyu datsuryo sochi no genjo to sono tenbo). Text in Japanese. Sekiyu Gakkai shi (J. Japan Petroleum Inst. Tokyo), 17(11):917- 921, Nov. 1974.*

Most heavy oil desulfurization processes used in Japan were first developed overseas and are of the fluidized bed type. There are 24 units in operation that use indirect desulfurization at reduced pressure to treat residual oil and 6 units that use direct desulfurization at normal pressure. In all the units used, hydrogen is introduced at conditions of high temperature and pressure. It has now become feasible to use large-scale desulfurizers safely. The problem of avoiding formation of hydrogen sulfide still exists, however. The Mobile desulfurization process has been introduced to solve this problem; it can be used to treat crude oil and has the feature of removing its own used catalysts automatically.

48875 **APTIC NO. 71139**

Tanaka, Kazuo, Toru Hashimoto, and Takao Shibata

A STUDY OF THE RESULTS FROM OPERATION OF SLDUGE INCINERATION AND EXHAUST GAS TREATMENT BY KAWAMATA DISPOSAL SITE. *(Kawamata shorijo odei shokyaku oyobi haigasu shori ni unten kekka ni taisuru ichi-kosatsu). Text in Japanese. Gesuido Kyokai shi (J. Japan. Sewage Works Assoc.), 11(125):49-58, Oct. 1974. 8 refs.*

The pressure and temperature distributions in the various stages of a multiple stage sludge incineration furnace are given. The drying temperature is from 200 to 500 C, the incinerating temperature is from 500 to 900 C, and the furnace pressure is constant. A scrubber is used to give high efficiency removal of sulfurous acid gas, dust, hydrogen chloride, and chlorine. The rate of removal of sulfur dioxide is 91% and that of dust is 69%. A wet absorbing tower, wet electrostatic precipitator, and a re-heat exchange are also employed.

48876 **APTIC NO. 71472**

Tatsutani, Bunkichi, Akiharu Muranushi, and Katsuhiko Yamamoto

TREATMENT METHOD OF GASES CONTAINING HYDROGEN FLUORIDE AND SULFUR DIOXIDE. *(Fukka suiso to nisanka iou konyu gasu no shori hoho). Text in Japanese. (Denki Kagaku Kogyo Co. Ltd., Tokyo (Japan)) Japan. Pat. Sho 49-47629. 4p., Dec. 17, 1974. (Appl. Feb. 7, 1970, 1 claim).*

An invention for the selective recovery of hydrogen fluoride and sulfur dioxide from waste gas emitted from phosphate fertilizer manufacturing processes is described. Waste gas containing 6.5 wt% water, 3100 ppm HF and 1600 ppm SO2 at 280 deg is introduced into a cooling tower at 670 N cu m/hr. Hydrogen fluoride solution (9.4 wt%) at 60 deg and water at 25 deg were sprayed from the top of the cooling tower at a rate of 700 l/hr and 63 l/hr, respectively. The resulting gas containing 15.9 wt% H2O at 60 deg is led to a gas absorbing tower to which water is supplied at 100 l/hr. Liquid containing 1.6 wt% HF and 0.005 wt% SO2 at 58 deg is released from the bottom of the tower while gas is introduced to a desulfurization tower to which sodium hydroxide solution is supplied. The resulting gas contains no detectable HF and 11 ppm SO2.

48877 **APTIC NO. 71383**

Thomaides, Lazarus

CATALYTIC EXHAUST PURIFIER FOR DIESEL ENGINES. *(Assignee not given.) U. S. Pat. 3,824,790. 5p., July 23, 1974. 5 refs. (Appl. March 14, 1974, 1 claim).*

A catalytic exhaust purifier for diesel engines is described. The purifier is designed to be readily removable while still providing a low pressure drop through the purifier which is necessary when operating with a diesel engine. The ready removal avoids the impracticality of cleanup in situ since the purifier can be removed and cleaned in a suitable oven while a substitute purifier is installed. Nonremovable purifiers require from 30 to 90 min/wk to clean. Additional expense is required for a preheater and control panel for supplying high temperature gases to the purifier.

48878 **APTIC NO. 71303**

Toda, G., M. Shiobara, and M. Kaneno

APPARATUS FOR HYDROCARBON EMISSION REDUCTION DURING DECELERATION. *(Gensoku doki no haishutsu tankasuiso gensho sochi). Text in Japanese. (Nissan Jidosha KK (Nissan Motors, Ltd.), Yokohama (Japan)) Japan. Pat. Sho 49-45256. 6p., Dec. 3, 1974. (Appl. Feb. 5, 1969, 1 claim).*

Excessive hydrocarbon emission during deceleration is counteracted by using a by-pass arrangement with a variable venturi-type carburetor. Opening and closing of this by-pass route is controlled by an electromagnetic valve, which is activated by vehicular operation conditions (acceleration, deceleration, or idling), via the following connections: transmission switch, clutch switch, electromagnetic valve, ignition switch, fuse, and battery. Proper amounts of air are supplied for satisfactory combustion of hydrocarbons.

48879 **APTIC NO. 71367**

Toda, Tadahide and Tokuhiko Nakamura

VARIABLE VENTURI TYPE CARBURETOR. *(Kahen benchuri gata kyabureta). Text in Japanese. (Toyota Jidosha Kogyo, Ltd. (Toyota Automotive Industries, Ltd.), Toyota City (Japan)) Japan. Pat. Sho 49-43849). 6p., Nov. 25, 1974. (Appl. June 21, 1971, 3 claims).*

An improved, variable venturi-type carburetor, with stabilized airflow, and resultant fuel aerosol formation and increased fuel vaporization in the intake manifold, is described. Negative pressure in the venturi chamber is maintained at a constant value by spring and piston action dependent on the closing action of a series of venturis. A main air-bleed regulator, consisting of a main air-bleed hole and regulating needle, is installed on each venturi. The amount of air flow is accurately controlled. A second main air-bleed is also installed on each venturi, from which air is allowed to collide with fuel emulsion before the mixture is ejected from the fuel jet opening in fine particulate form.

48880 **APTIC NO. 71491**

Toda, Yoshio, Masaji Shiobara, and Mitsutaka Konno

AUTOMOTIVE AIR-POLLUTION PREVENTIVE SYSTEM. *(Nissan Motor Co., Yokohama City (Japan)) U. S. Pat. 3,821,943. 11p., July 2, 1974. 8 refs. (Appl. Feb. 22, 1972, 1 claim).*

A system for controlling the air/fuel mixture received by an internal combustion engine equipped with a variable venturi carburetor is described that uses a bypass mixture passage to supply an additional air-fuel mixture of optimum amount and ratio during deceleration, thus reducing unburnt hydrocarbon emissions during deceleration. The bypass mixture passage is connected between the mixing chamber and the intake manifold and operates only during the deceleration mode. During deceleration with the throttle valve substantially closed, a predetermined amount of air-fuel mixture is delivered from the mixing chamber through the deceleration passage into the intake manifold due to the abruptly increased pressure difference between the mixing chamber and the intake manifold.

48881 **APTIC NO. 71374**

Torii, Takeo

LOW NOX BURNER OF SUNRAY REINETSU CO. *(Sanrei reinetsu no tei NOx bana). Text in Japanese. Netsu Kanri To Kogai (Heat Management Public Nuisance), 26(12):41-45, Dec. 1974.*

A rotary oil burner and gas burner developed by Sunray Reinetsu Co. are described. The shape of the window box used to supply air evenly was altered and air was supplied by two or more stages to reduce the maximum flame temperature. Results from a test furnace showed 20 to 30% nitrogen oxides reduction at maximum combustion. An exhaust recycling rotary oil burner showed 20% NOx reduction as compared to an ordinary rotary burner. Preliminary results revealed that the combination of the two could reduce NOx up to 50%. An LG type multi-stage gas burner which used circulated primary air and straightly sprayed secondary air for complete mixing of gas and air resulted in NOx reduction as well as carbon monoxide reduction.

48882 **APTIC NO. 71096**

Tsugawa, Sadao

THE PRESENT CONDITION AND FUTURE OF ENVIRONMENTAL PRESERVATION TECHNOLOGY. *(Kankyu hozen gijutsu no genjo to shorai). Text in Japanese. Nihon Kikai Gakkai shi (J. Japan Soc. Mech. Engrs.), 77(673):51-56, Dec. 1974. 8 refs.*

The general status of environmental pollution is reviewed, and various control techniques for air pollution, water pollution, and refuse treatment are also reviewed. For air pollution, desulfurization techniques for heavy oil and exhaust gas, denitration techniques by combustion modification and denitration methods, for exhaust gas, and particulates control by sedimentation, inertial dust collector, cyclone, liquid scrubbing, filtration, and electrostatic precipitator are discussed. As for water pollution, control techniques by physical, chemical and biochemical methods are reviewed. General treatment procedures for bulky refuse are also discussed.

48883 **APTIC NO. 71097**

Tsuji, Shoichi

DEVELOPMENT OF LOW NOX BURNER. *(Tei NOx bahna no kaihatsu). Text in Japanese. Nihon Kikan Gakkai shi (J. Japan Soc. Mech. Engrs.), 77(673):18-22, Dec. 1974.*

For the purpose of reducing nitrogen oxides formation, six new types of burner were designed and tested. Six combustion mechanisms developed are pressure spray split combustion, vapor spray split combustion, staged vapor spray long flame combustion, circulation swirl region mixed combustion, circular flat flame combustion, and fan-shaped flat flame combustion. Each burner was tested using small and large scale pilot furnaces, results were analyzed in terms of NOx and soot corcentrations, and split flame combustion was found to be most effective for NOx reduction. The split flame burners were installed in existing boilers, and NOx reduction rates of 40-18% were obtained.

48884 **APTIC NO. 71341**

Tsuji, Shoichi

LOW NOX BURNER OF ISHIKAWAJIMA HARIMA HEAVY INDUSTRIAL CO. *(Ishikawajima Hirima Jukogyo no tei NOx bana). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 26(12):21-24, Dec. 1974. 1 ref.*

Two types of burner of the divided flame type are described. The first one is a swirl type pressure-jet valve with sticks at its nose or with channels at its tip. The flame is divided into a group of small flames. The second type of an internal mixing type vapor jet valve with many nozzles arranged in such a way that the divided flames do not interfere with one another. Results of application of the divided flame burner in boilers showed that the effects of nitrogen oxides reduction were greatest when it was used alone without combining other measures such as exhaust gas recirculation and two-stage combustion. The NOx reduction increased as the area load factor of combustion of the boiler increased.

48885 **APTIC NO. 71304**

Uchiyama, Yoshihiro

DESULFURIZATION APPARATUS FOR EXHAUST GASES. *(Haigasu datsuryu sochi). Text in Japanese. (Hitachi, Ltd., Tokyo (Japan)) Japan. Pat. Sho 49-45218. 3p., Dec. 3, 1974. (Appl. May 28, 1971, 2 claims).*

Desulfurization of high temperature exhaust gases in the presence of seawater is described. Exhaust gases, containing sulfur oxides, come into intimate contact with desalinated seawater in a vapor-liquid contact tower. The temperature of exhaust gases is lowered, and sulfur oxides are readily adsorbed (on adsorbents such as activated carbon) and removed. Sulfuric acid from the desulfurization process is used to adjust the pH for decarbonation of seawater in the desalination process. By placing finely crushed limestone in the vapor-liquid contact tower, neutralization of seawater containing sulfuric acid occurs. This treated seawater is introduced into the desalination installation and expelled into the ocean. The composition of expelled seawater is about the same as that of the original seawater.

48886 **APTIC NO. 70693**

Ueda, Masaru

ACTUAL STATE OF ORGANIC SOLVENT RECOVERY AND HARMFUL GAS OFFENSIVE ODOR REMOVAL Y ACTIVATED CARON ADSORPTION METHOD. *(Kasseitan Kyuchaku ni yoru yukiyozai no kaishu to yugaigasu, akushu jokyo no jissai). Text in Japanese. Kankyo Sozo (Environ. Creation), 4(4):67-72, April 1974. 4 refs.*

In a plant designed for recovery of organic solvents by activated carbon adsorption, air mixed with a solvent gas is cooled to 40 C or below by a gas cooler and blown into an adsorption column by a gas blower. The gas should be cooled to a sufficiently low level for a higher rate of adsorption. For wasteless input of the solvent gas into the adsorption column, the solvent gas generation source should be set to a pressure level somewhat lower than the atmospheric pressure. The blower and the duct connecting the blower to the adsorption column should be made of materials hard to flash with static electricity and sparks. The motors, lighting, and switches must be protected by anti- explosion devices. Several adsorption columns are used in one plant, depending on quantity of the solvent to be recovered and on the operating conditions. The solvent gas is treated by the activated carbon layer in the adsorption column to remove the solvent from the gas. The treated gas now free of the solvent is discharged into the atmosphere. When one adsorption column has adsorbed the solvent to its saturation point, another adsorption column will be used until saturated. The saturated column is regenerated by low-pressure steam fed into it for desorption of the adsorbed solvent from the activated carbon layer. The mixture gas of the solvent vapor- and water vapors driven out of the adsorption column is cooled by the condenser and after-cooler and recovered as a liquid. A few of the small-, medium-, and large-sized solvent recovery plants introduced include the Cubical asket Adsorption Equipment, the Sector asket Adsorption Equipment, the Cylindrical asket Adsorption Equipment, and the Closed System Adsorption Equipment. The safety measures and devices to prevent possible explosion are described. Odor removal by activated carbon adsorption is also discussed.

48887 **APTIC NO. 71239**

Urban, Peter

CONTINUOUS PROCESS FOR SCRUBBING SO2 FROM A GAS STREAM WITH CO REGENERATION AND CO2 STRIPPING. *(Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,808,325. 9p., April 30, 1974. 5 refs. (Appl. Oct. 28, 1971, 18 claims).*

A continuous scrubbing process for the removal of sulfur dioxide from flue gas and which controls sulfate by-product formation common in other processes is described. A conventional alkaline procedure is coupled with a regeneration procedure using thiosulfate as an intermediate in a multistep operation designed to convert the sulfite compound contained in the rich absorbent stream to hydrogen sulfide, rather than an attempt to directly reduce the sulfite compound to sulfide in a single step operation. This sulfite-to-thiosulfate-to-sulfide route provides a regeneration procedure which facilitates careful control of by-product formation during the regeneration operation and enables the production of a regenerated absorbent stream which can be directly recycled to the scrubbing step. This allows the system to be operated in a closed-loop fashion with respect to absorbent stream.

48888 **APTIC NO. 71399**

Ushimaru, Yutaka, Koichi Matsuo, and Yukihiro Tochio

CATALYST FOR USE IN CONVERSION OF GASES AND METHOD FOR PREPARING THEREOF. *(Mitsui Mining and Smelting Co., Ltd., Tokyo (Japan)) U. S. Pat. 3,824,194. 5p., July 16, 1974. 3 refs. (Appl. Aug. 2, 1972, 8 claims).*

A molded catalyst for the conversion of carbon monoxide, hydrocarbons, and nitrogen oxides in automotive exhaust emissions to nonpollutants is described. The catalyst is superior to other catalysts in respect to chemical efficiency, heat resistivity, and mechanical strength. The catalyst is prepared by mixing a manganese oxide or a mixture containing a manganese oxide with one metal powder selected from the group consisting of copper, iron, and zinc powder. A chromate film is formed on the surface of the metal powder by dipping the mixture into chromic acid and molding the treated mixture. The chromate film on the powder acts as a binder and gives the catalyst its increased mechanical strength.

48889 **APTIC NO. 71379**

Van Diepenbroek, Alfred Erich Wibrandt

APPARATUS FOR PURIFYING A GAS. *(Bronswerk-Apparatenbouw N.V. v/h Moring and Steenaart, Nijerk (Netherlands)) U. S. Pat. 3,824,768. 6p., July 23, 1974. 6 refs. (Appl. July 21, 1972, 3 claims).*

An atomizer which converts water into a liquid mist for purification is described. The mist obtains an electric potential different from the electric potential of the air impurities which increases the force of attraction between the mist particles and the impurities. The liquid provides an extremely large contact surface for the impurities which is an advantage over a similar known process. The distance between the mist particles and the impurities is extremely small giving the mist a very great absorbing capacity.

48890 **APTIC NO. 71453**

Vargyai, Jozsef

FLY-ASH UTILIZATION IN THE SERVICE OF ENVIRONMENTAL PROTECTION. *(Pernyehasznositas a kornyezetvedelem szolgalataban). Text in Hungarian. Tatabanyai Szenbanyak Musgaki-Kozgazdasagi Kozl., 14(2-3):119-120, April-Sept. 1974. 10 refs.*

The environmental problems created by fly ash generated in coal-fired power plants, and possibilities of its utilization in Hungary are discussed. Accumulated fly ash and slag near power plants, now amounting to some 60,000,000 tons, causes air pollution by drifting in windy weather, and makes vast areas unsuitable for farming. The space requirement is not negligible. Large amounts of fly ash and slag can be used as an additive in various construction materials. Extraction of aluminum and iron is proposed by Polish experts.

48891 **APTIC NO. 71076**

Vayssiere, Pierre

METHOD AND APPARATUS FOR TREATMENT OF GASES. *(Institut De Recherches Da La Siderugie Francaise (IRSID), Saint-Germain-en- Laye (France)) U. S. Pat. 3,820,510. 6p., June 28, 1974. 4 refs. (Appl. Dec. 26, 1972, 8 claims).*

An integrated system for the removal of dusts from gas streams of an oxygen steel plant is described which utilizes the high calorific value of certain auxiliary gas streams for combustion of the main stream. The main stream is burned in a combustion chamber in the presence of corresponding stoichiometric amounts of gas originating from auxiliary pollution sources. The resultant burned gases are cooled with other gases from polluting sources, and part of the recovered heat is reused. The cooled gases are then passed through a dust filter prior to discharge. (Author abstract modified)

48892 **APTIC NO. 71068**

Viland, Clare Kenneth

METHOD AND APPARATUS FOR PREVENTING LOSS OF HYDROCARBONS TO ATMOSPHERE. *(Assignee not given.) U. S. Pat. 3,815,327. 6p., June 11, 1974. 4 refs. (Appl. May 14, 1973, 17 claims).*

A vapory-recovery system for the collection of hydrocarbon gases which normally escape during vehicle tank fueling or gasoline storage tank filling is described. The hydrocarbon vapors are collected at the point of entry under controlled pressure conditions with a sealing device fitted to the tank being filled. A delivery hose centered in the sealing device vents the release of hydrocarbon vapors to an enclosed annular space which is connected by a vapor delivery line to a condenser unit. After dehydration and condensation, the recovered liquid is returned to the service station s storage tankage, preferably at a point below the liquid level of the tank. The essentially hydrocarbon- free gas, mainly air, is discharged to the atmosphere.

48893 **APTIC NO. 71126**

Waller, Geoffrey

ADSORPTION. *Chem. Ind. (London), no. 21:853-856, Nov. 2, 1974. 10 refs.*

The adsorptive removal of organic materials, particularly odors, from gaseous streams with activated carbon is reviewed. Activated carbons with pore diameters of less than 20 A diameter are particularly suitable for odor removal. For single component systems, the adsorption capacity increases with increased concentration and decreases with increased temperature. The design of systems where odorants are to be recovered should always be based on working capacity of the adsorbent which is the difference between saturation capacity and residual capacity. A good odor removal carbon with a pore structure developed with good retentivity may accommodate trace contaminants in an air stream but may not necessarily be a good material for higher contaminant concentrations and recovery of the adsorbate. Odor molecules which are condensed within the pores of activated carbon can normally be revolatized and removed by raising the temperature or reducing the pressure of the system. The approximate lifetime of an activated carbon adsorbent can be calculated if a specific compound is known to be the odorant and its concentration and temperature are known. Mercaptans, chlorinated compounds, alcohols, esters, and aldehydes are readily adsorbable up to 35% by weight under proper conditions, but it is unlikely that more than 10% by weight loading can be achieved for low influent concentrations. The catalytic effect of activated carbon can also be used for the collection of odors. Examples include the catalytic oxidation of hydrogen sulfide to sulfur, the oxidation of sulfur dioxide to sulfur trioxide, the oxidation of nitric oxide to nitrogen dioxide, and the formation of dimethyl sulfide from methyl mercaptan.

48894 **APTIC NO. 70831**

Wassell, A. B.

DEVELOPMENT OF POLLUTION CONTROLS FOR ROLLS-ROYCE RB 211 AND OLYMPUS 593 ENGINES. *Preprint, Society of Automotive Engineers, New York, 12p., 1974. 20 refs. (Presented at the Society of Automotive Engineers Air Transportation Meeting, Dallas, Tex., April 30-May 2, 1974, Paper 740483.)*

The development of pollution control for Rolls-Royce RB 211 and Olympus 593 gas turbine aircraft engines is reviewed. Smoke reduction programs include the employment of airspray fuel injectors and vaporizers along with annular combustor developments. Refinements in combustor design and modifications reducing fuel droplet size are currently being evaluated for the reduction of carbon monoxide and unburnt hydrocarbon emissions. The control of nitrogen oxides is most likely to be achieved by water injection in order to meet the 1979 Environmental Protection Agency standards. Two on-line measuring systems for emissions evaluation are currently also being developed. One involves the use of an optical smokemeter to determine exhaust plume opacity and the second samples exhaust pollutants downstream of the engine, after dilution with ambient air.

48895 **APTIC NO. 71339**

Watanabe, Yasuyuki

LOW NOX BURNER OF OSAKA GAS CO. *(Osaka gasu no tei NOx bana). Text in Japanese. Netsu Kanri to Kogai (Heat Management Public Nuisance), 26(12):63-66, Dec. 1974.*

Two types of low nitrogen oxides burners, for boilers and two for heating furnaces are being developed by the Osaka Gas Co. The first type for boilers is a waste gas recirculation process featuring the use of the spraying pressure of fuel gas for the suction of waste gas into the burner. A fuel gas pressure higher than 1000 mm water is required and the burner is suitable for boilers of 30 tons/hr capacity. The second type for boilers is a combination of waste gas recirculation and two-stage combustion featuring the use of the spraying pressure of secondary air for suction. The burner is suitable for small boilers for industry and air conditioners. The first type for heating furnaces is bias combustion featuring the use of two burners, one with excess air and the other with excess fuel gas, and the burners being associated with an equal pressure control device. The second type for heating furnaces is a two-stage combustion process with adjustable primary and secondary air. All burners showed high performance for NOx reduction.

48896 **APTIC NO. 71284**

Weir, Alexdander, Jr., John M. Johnson, Dale G. Jones, and William C. Martin

SCRUBBING AT THE MOHAVE STATION. *National Coal Assoc., Washington, D. C., Coal Util. Symp. - Focus SO2 Emiss. Control, Louisville, Ky., 1974, p. 102-114. 1 ref. (Oct. 22-24.)*

A program designed to test the effectiveness of horizontal and vertical module-type lime-limestone scrubbing systems for the removal of sulfur dioxide and particulates from the stack gases of a 1580 MW coal-fired generating station owned by Southern California Edison is described. The test program is being conducted on a 24-hr/day, 7-day/wk basis, with both modules being operated on a normal manpower rotation basis. The program includes: operating both modules on lime and limestone reagents; spiking the inlet SO2 concentration from 200-400 ppm to simulate conditions of 0.83% sulfur coal; flexibility testing to determine turn-up/turn-down and the effects of liquid/gas ratio and other variables on removal efficiencies; and long-term duration testing under conditions of operation at thye power station. Two separate waste disposal systems are being evaluated: a system which involves mixing a hardening agent into the sludge followed by disposal in a waste pond and a technique involving the mixing of fly ash, scrubber sludge, and a hardening agent to produce a lightweight aggregate. The tests are in the beginning stages, and results are not yet available.

48897 **APTIC NO. 70902**

White, Harry J.

ELECTROSTATIC PRECIPITATORS - MAJOR FIELDS OF APPLICATION, TECHNOLOGY, AND PROBLEM AREAS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 55-78. 12 refs. (Jan. 15-18, Paper 3.)*

Major industrial applications of electrostatic precipitators are reviewed. Fly ash collection in the electric power industry accounts for about 75% of the total gas volume cleaned by electrostatic precipitation in the United States. This is followed by metallurgical, cement, and paper mill applications, each of which accounts for 5-10% of electrostatic precipitator usage. Virtually all precipitators are currently being designed for 99% or greater collection efficiency. Newer trends in precipitator applications include: the use of precipitators ahead of air preheaters in power plants to avoid high resistivity problems associated with low-sulfur coals, the change from wet-bottom to dry-bottom precipitators in paper mills using odor-free recovery boilers, the treatment of basic oxygen furnace gases after cooling and humidifying pretreatment, the use of wet precipitators in aluminum reduction plants to reduce particle emissions from reduction furnaces and mist carryover from scrubbers, the use of precipitators with municipal incinerators, and the use of electrostatic precipitators with newer processes such as magneto- hydrodynamic power generation and coal gasification. Examples of problems that are sometimes encountered with electrostatic precipitators include: high resistivity, poor gas flow, poor electrode alignment, breakage of corona wires, air leakage into the hoppers, gas flow overloading, and deficient electrical energization.

48898 **APTIC NO. 70990**

Whitman, Robert Henry and Louis Leonard Lento, Jr.

CATALYST FOR ELIMINATION OF POLLUTANTS IN AUTO-EXHAUST GAS. *(American Cyanamid Co., Stamford, Conn.) U. S. Pat. 3,819,534. 6p., June 25, 1974. 4 refs. (Appl. May 18, 1972, 9 claims).*

A catalyst for oxidizing hydrocarbons and carbon monoxide in exhaust streams from internal combustion engines is described that exhibits less shrinkage, faster warm-up, and greater conversion than prior-art designs. A calcined support material of alumina, silica, magnesia, zirconia, or mixtures thereof is prepared and treated with an alkaline earth metal such as calcium, barium, strontium, or a mixture thereof in quantities ranging from 1.5-10% by weight of the calcined support. The treated support is calcined at 1800 F for at least 1 hr to convert the alkaline earth metal to its oxide and to stabilize the support against excessive shrinkage. The stabilized support is then impregnated with a chromium compound (0.5-40% by weight) and with a copper compound (1-12% by weight). The impregnated stabilized support is then calcined. Conversions of 50% for carbon monoxide and hydrocarbons are achieved at temperatures of 550 and 650 F, respectively. Shrinkage is about 14% or less under normal conditions of use.

48899 **APTIC NO. 71117**

Wiley, Robert F.

CATALYTIC CONVERTER. *(Corning Glass Works, Corning, N. Y.) U. S. Pat. 3,817,714. 5p., June 18, 1974. 12 refs. (Appl. Oct. 10, 1972, 4 claims).*

A catalytic oxidation converter for reducing exhaust emissions from internal combustion engines is described which is relatively economical and durable in comparison with prior-art converters and which provides a means for cooling the housings or casings of the converter. The converter includes pairs of circular, frusto-conical, concentric metal housings, or casings which form a container circumferentially surrounding a cylindrical honeycomb core catalytic member. The catalytic member is made of a material having high temperature durability and a low coefficient of thermal expansion (e.g., a refractory ceramic). The container is designed to compensate for differences in thermal expansion between the converter material and the metal material of the housings or casings of the container. Annular spaces are provided between each pair of housing or casings along with an air supply means to aid in cooling the housings or casings while oxygen is supplied for the catalytic oxidation of the exhaust gases. (Author abstract modified)

48900 **APTIC NO. 71381**

Williams, John K.

GAS AND PARTICULATE SOLID MATERIAL SEPARATING AND SOLID MATERIAL DISCHARGING APPARATUS. *(Central Texas Iron Works, Inc., Waco, Tex.) U. S. Pat. 3,824,771. 11p., July 23, 1974. 5 refs. (Appl. May 22, 1973, 8 claims).*

An apparatus for separating gas from particulate solid matter entrained in a stream of the gas is described. It consists of a blower, receptacle, and ducting providing a substantially closed system in which gas is recirculated. The solid material is separated from the circulating gas and deposited in the collection receptacle. A portion of the circulating gas, usually not exceeding 30% by volume, is bled from the circulatory system and discharged to maintain the average pressure in the circulating system at a desired low value. This prevents leakage blow-out of gas and entrained dust or fine solids. In other systems air is drawn into the suction side of the system which increases the average pressure throughout the system. The increased pressure causes some air with entrained dust to be discharged in the atmosphere. (Author abstract modified)

48901 **APTIC NO. 71130**

Winkley, Jerry H.

CARBURETOR WITH COMBINED PISTON MOTOR AND DIAPHRAGM MOTOR CHOKE VALVE ACTUATION. *(ACF Industries, Inc., New York) U. S. Pat. 3,814,390. 5p., June 4, 1974. 6 refs. (Appl. July 5, 1972, 6 claims).*

An automatic carburetor choke control system for maintaining the air/fuel composition at a ratio conducive for low exhaust emissions is described that provides for greater flexibility of control under different operating conditions than prior-art systems. A piston motor which is responsible to manifold vacuum opens the choke valve partially during warm-up. A diaphragm motor, which responds more slowly to engine vacuum, acts through a modulating spring to further open the choke valve at high ambient temperatures, thus leaning the air/fuel mixture. The choke valve is normally urged closed at low ambient temperatures by a thermostatic coil spring. (Author abstract modified)

48902 **APTIC NO. 71039**

Wunderlich, Guenter and Heinrich Weber

PROCESS FOR THE MANUFACTURE OF SULFUR OR SULFURIC ACID FROM COKE OVEN GAS. *(Assignee not given.) U. S. Pat. 3,819,816. 8p., June 25, 1974. 7 refs. (Appl. April 20, 1972, 5 claims).*

A process for the complete elimination of ammonia and hydrogen sulfide from coke oven gases is described which does not lead to the occurrence of sulfur dioxide-containing condensates as in prior-art methods. Most of the hydrogen sulfide combustion gases are cooled only to the point where elementary sulfur condenses out on the cooler bottom. The process initially involves scrubbing the coke oven gases with water, recycling the aqueous ammonia solution, and desorbing the water and aqueous ammonia solution with either steam or combustible or non-combustible gases in a deacidification process. Thereafter, the ammonia and hydrogen sulfide in the desorption gases are enriched, scrubbed with water, and recycled. The damp vapors are burned with sufficient air for converting ammonia to nitrogen and water and obtaining elementary sulfur or sulfuric acid from the hydrogen sulfide. The damp vapors recovered from the deacidification are divided into two fractions, one containing ammonia and the other containing hydrogen sulfide. The two fractions are burned separately, and the condensate is separated from the gaseous combustion product streams, with the two streams then being combined. The temperature and/or concentration of the gases is adjusted before further processing. (Author abstract modified)

48903 **APTIC NO. 71307**

Yagi, Shizuo

APPARATUS FOR ENGINE COMBUSTION CHAMBER. *(Enjin no nensho shitsu sochi). Text in Japanese. (Honda Giken Kogyo, KK (Honda Technical Research Industries, Ltd.), Tokyo (Japan)) Japan. Pat. Sho 49-44803. 2p., Nov. 30, 1974. (Appl. Dec. 14, 1971, 1 claim).*

The ignition characteristics in the secondary chamber of an engine with a two-compartment combustion chamber setup are improved by a diaphragm arrangement which enlarges the opening between the main chamber and the secondary chamber during idling. Enough air is introduced into the secondary chamber, even at comparatively low speeds, so that mixing occurs readily. At higher speeds, less air is introduced, and excessive agitation of the mixture, which also causes poor ignition, does not occur.

48904 **APTIC NO. 70939**

Yergey, Alfred L., Frederick W. Lampe, Marvin L. Vestal, Alan G. Day, Gordon J. Fergusson, William H. Johnston, Judith S. Snyderman, Robert H. Essenhigh, and James E. Hudson

NONISOTHERMAL KINETICS STUDIES OF THE HYDRODESULFURIZATION OF COAL. *Ind. Eng. Chem., Process Des. Develop., 13(3):233-240, July 1974. 30 refs.*

Laboratory experiments with 10 bituminous coals were performed to study the nonisothermal kinetics of coal hydrodesulfurization. The evolution of hydrogen sulfide during hydrodesulfurization was described by a sulfur release, in order of increasing temperatures, characterized by evolution of the following five sulfur types: Organic I, Organic II, pyrite, sulfide, and Organic III. Notable exceptions were the evolution of H2S by a process occurring in a temperature range intermediate to the pyrite and sulfide evolution peaks and a higher temperature H2S evolution that was not reproducible and may have been an experimental artifact. The most important back-reaction of H2S with partially desulfurized coal was the inhibition of H2S release by iron. The reaction orders for sulfur removal in pyrite and Organic III were 0.5 and 2, respectively, rather than unity. The former was rationalized by supposing the existence of an equilibrium between iron pyrite, iron, and adsorbed sulfur as well as a rate-determining step that involves reaction of hydrogen with adsorbed sulfur. The latter case with a reaction order of 2 suggests that, in the rate-determining step of sulfur evolution from Organic III, two sulfur-containing species must be involved. The Organic III form of sulfur may not be an original component but rather the result of reaction of H2S with partially desulfurized coal during hydrodesulfurization.

48905 **APTIC NO. 70994**

Yoshida, Yoshinaga, Toshiyuki Kii, Shigehiko Kobayashi, Kazuhide Miyazaki, Michiaki Yamamoto, and Yasuo Seki

CATALYTIC REACTION APPARATUS FOR PURIFYING WASTE GASES CONTAINING CARBON MONOXIDE. *(Mitsui Mining and Smelting Co., Ltd., Tokyo (Japan)) U. S. Pat. 3,819,334. 12p., June 25, 1974. 12 refs. (Appl. Oct. 6, 1971, 7 claims).*

A catalyst for the oxidation of carbon monoxide in exhaust gases from internal combustion engines is described that exhibits improved resistance to deterioration. At least 5% by weight of a hydrated oxide or oxides of iron, nickel, manganese, or manganese dioxide is dispersed with a powder catalyst having oxides of manganese, lead, and/or bismuth as its principal components in an organic solution containing alkoxytitanate, alkoxy substituted organosilane, or dimethyl polysiloxane. Alternatively, the catalyst powder may be dispersed in a heat-resistant paint prepared from a liquid compound having a siloxane bond as the vehicle. A catalyst carrier consisting of several metal plates is connected at its ends to a metal structure configured to be suitable for cooling the gas-solid heterogeneous catalytic reaction. (Author abstract modified)

48906 **APTIC NO. 70472**

Zhukov, V. I., T. N. Livke, P. K. Zaika, I. I. Voldaeva, and M. V. Gavrilyuk

WAYS OF REDUCING AIR POLLUTION BY GASES AND PARTICULATES AT CHEMICAL ENTERPRISES. *(Puti snizheniya zagazovannosti i zapylennosti vozdukha na predpriyatiyakh khimicheskoi promyshlennosti). Sov. Chem. Ind. (English translation from Russian of: Khim. Prom.), 6(5):316-317, May 1974.*

Working conditions were analyzed in the main plants at a number of industries including a pyrite roasting shop, sulfuric acid synthesis sections (contact and tower methods), and double and simple superphosphate, nitroammophos, and wet-process phosphoric acid shops. The nature of the work of the main trades at the 117 work sites studied was such that workers were exposed to the effects of polluted air. Dust concentrations occurred when raw materials were loaded, unloaded, transported, and ground, when finished product was discharged and packaged, when screw conveyors and spouts were cleaned, and when work sites were rearranged. Noise and vibration levels were also high. Analyses of reports of temporary disabilities showed 30% of the cases involved pneumonia, 27% involved upper respiratory ailments, 2% involved bronchitis, and 5% involved gastroenteritic illness. Thus, dust had a harmful effect. Dust removal installations are being installed in several chemical and fertilizer plants, and alkaline absorption and other methods of purifying stack gases are being used to solve air pollution problems.

48907 **APTIC NO. 71494**

Zink, John Smith, Robert D. Reed, and Hershel E. Goodnight

SMOKELESS FLARE USING LIQUID WATER PARTICLES. *(John Zink Co., Tulsa, Okla.) U. S. Pat. 3,814,567. 6p., June 4, 1974. 7 refs. (Appl. Feb. 22, 1972, 14 claims).*

A smokeless flare for the reforming of hydrocarbon gases with a hydrogen-to-carbon mass ratio of less than 0.25 is described that uses liquid water rather than steam to increase the hydrogen-to-carbon ratio. An atomizer that uses the pressure of the gas to provide energy for atomizing the water into droplets of less than 200 micron in size is used. The small water droplets instantly evaporate in the flame and provide the water vapor to reform the hydrocarbons and achieve the necessary hydrogen-to-carbon ratio for smokeless combustion. (Author abstract modified)

48908 **APTIC NO. 70807**

National Academy of Engineering, Washington, D. C., Ad Hoc Panel on Evaluation of Coal-Gasification Technology

EVALUATION OF COAL-GASIFICATION TECHNOLOGY. PART II. LOW- AND INTERMEDIATE-BTU FUEL GASES (INTERIM REPORT). *Office of Coal Research Contract 14-32-0002-1216, Rept. OCR-74-Int. 2, 102p., March 1974. 48 refs.*

NTIS: PB 234042

Coal gasification technology is evaluated in terms of the production of low- and intermediate-BTU fuel gases. Gasification processes considered include: moving bed (dry ash and slagging), fluidized bed (dry ash and ash agglomerating), entrainment, entrainment-slagging, and molten bath processes. Low-BTU gas with a heating value of about 150 BTU/standard cu ft can be produced from coal by partial combustion with air and steam, while intermediate-BTU gas with a heating value of 300-400 BTU/standard cu ft can be produced from coal by partial combustion with oxygen and steam. Both types of gas can be made free of sulfur, particulates, and other impurities. Processes for producing low- and intermediate-BTU gases are less complex and costly than those for producing pipeline quality gas. Intermediate-BTU gas, which may be economically transported for a considerable distance, could supply gas to utility and industrial plants in a limited area. The effect of the high capital cost of gasification plants can be minimized by designing them to supply fuel primarily for base-load operations. Coal gasification for new power plants is much more efficient if used in a combined-cycle operation consisting of a steam boiler- turbine cycle powered by the hot exhaust gases of a gas turbine. Improvements in gasification processes appear to be limited in the amount they can reduce capital and operating costs. Pulverized-fuel gasifiers may make feasible single units offering greater capacity than moving-bed gasifiers with lower capital and operating costs.

1973

48909 **APTIC NO. 70876**

Chalishazar, B. H. and M. C. Goyal

AIR POLLUTION AND CONTROL TECHNIQUES IN CHEMICAL INDUSTRIES. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 233-241. (Sept. 11-12.)*

Control techniques for the reduction of pollutants commonly emitted from chemical processing operations are reviewed. Sulfur dioxide may either be treated at the stack by various scrubbing processes (absorption) and by adsorption or at the source by fuel gasification. Improvements in combustion can also reduce SO2 emissions. Hydrogen sulfide reduction can be accomplished by absorption, various reductive methods (e.g., Claus method), combustion to sulfuric acid, or oxidation. Nitrogen oxides can be controlled by absorption, burning, catalytic combustion, or the use of secondary air. Mist eliminators, wet scrubbers, incinerators, dust collectors, bag filters, cyclone separators, electrostatic precipitators, and high stacks are devices which can be used to reduce particulate emissions. Removal of hydrocarbons from waste gas streams may involve recovery by adsorption, destruction by combustion, catalytic combustion,a nd the use of flare systems. Chlorine gas recovery can be achieved by conversion of the gas to sodium hypochlorite or calcium hypochlorite byproducts using lime slurry. Carbon disulfide liberation can be reduced by exhaust gas cooling (condensation of the vapor) and by activated charcoal adsorption.

48910 **APTIC NO. 71235**

Conser, R. E. and R. F. Anderson

NEW TOOL COMBATS SO2 EMISSIONS. *Oil Gas J., 71(44):81-86, Oct. 29, 1973.*

The operation and economics of the Shell flue-gas desulfurization process are described. Stack gas from the combustion of fuel oil from widely varying crude origins has normal particulate levels ranging to 0.12 gr/scf with higher values encountered during soot-blowing. No net sulfate or sulfite is produced. All the sulfur is recovered in the form of pure sulfur dioxide suitable for sale or processing in a conventional Claus unit to yield elemental S. Changes in flue gas rate, SO2 content, or desired SO2 removal can be accommodated easily by changing cycle length. The economics of three types of units are examined: processing flue gases from process heaters plus incinerated tail gas from a Claus unit; processing flue gas from an FCC unit; and an independent unit for a power-generation facility.

48911 **APTIC NO. 70896**

Desai, H. B.

AIR POLLUTION CONTROL TECHNOLOGY IN PETROLEUM REFINERIES. *Central Labour Inst., Sion, Bombay (India), Proc Semin. Air Pollut. Control Tech., India, 1973, p. 252-263. (Sept. 11-12.)*

Control techniques for reducing emissions from petroleum refineries are reviewed. Afterburning in a boiler provides an effective means of controlling carbon monoxide emissions from cracking unit regenerators; heat is recovered for steam generation. Sulfur oxides can be controlled by increasing stack height, switching to a low-sulfur fuel, or by fuel processing. Tankage losses of hydrocarbons can be minimized by the use of floating roof tanks, the proper maintenance of roof-seals, and vapor recovery systems. Particulates from catalytic cracking regenerator flue gases are effectively controlled by cyclones. Most of the abatement steps which can be selected for the control of SOx and nitrogen oxides are also effective in controlling particulate emissions from oil-fired furnaces and boilers. These include: fuel oil desulfurization, stack gas scrubbing, and combustion modification (for NOx control). Particles greater than 5 micron can be controlled realtively easily by electrostatic precipitation. Ammonia can be removed from refinery gases by scrubbing with water, followed by treatment of the ammonia with sulfuric acid for ammonium sufate by-product recovery. Hydrogen sulfide is usually removed from gases by scrubbing.

48912 **APTIC NO. 71234**

Engdahl, Richard E., Joseph M. Genco, David M. Jenkins, Joseph H. Oxley, and Harvey S. Rosenberg

SO2 CONTROL: LOW-SULFUR COAL STILL THE BEST WAY. *Power Eng., 77(11):72-76, Nov. 1973.*

The commercial application of sulfur dioxide control processes is discussed. The National Academy of Engineering Ad Hoc Panel s definition of proven industrial scale acceptability is satisfactory operation on a 100-Mw or larger unit for more than 1 yr. Both recovery and throwaway control methods can be carried out in either wet or dry systems. Throwaway methods may convert an air pollution problem to a water pollution or solid waste disposal problem. Dry removal systems generally do not require stack gas reheat, as wet systems may. Wet systems can remove particulate matter and SO2 simultaneously. Seven SO2 control processes and the major utility companies using them are discussed. The processes are these: wet lime/limestone scrubbing; alkali scrubbing, no regeneration; alkali scrubbing with calcium regeneration; alkali scrubbing with thermal regeneration; alkali scrubbing with electrolytic regeneration; magnesium oxide scrubbing; and catalytic oxidation. Most utilities will not meet 1975 or 1977 deadlines for current SO2 control regulations unless they switch to low sulfur fuel.

48913 **APTIC NO. 71261**

Izmerov, N. F.

CONTROL OF AIR POLLUTION IN THE USSR. *World Health Organization, Geneva (Switzerland), Public Health Papers 54, 160p., 1973. 149 refs.*

The sources and control of air pollution in the USSR are discussed. The main sources of pollution are heating and power plants, ferrous and non-ferrous metallurgy, the petroleum and petrochemical industries, and transportation. The principles underlying the establishment of air quality standards are discussed including criteria and methods for establishing maximum permissible concentrations of atmospheric pollutants. The maximum permissible concentrations are tabulated for 114 pollutants including nitrogen oxides, hydrocarbons, particulates, sulfur compounds including oxides, and metals and their compounds such as lead, mercury, arsenic, manganese, and vanadium. The health protection zones which were established for industries and other sources of pollutants are presented. Methods for removing suspended particulates from gases are mechanical or dry gas purification, wet gas purification, filtration, and electrostatic precipitation. The removal of sulfur dioxide, carbon monoxide, and NOx from gases are described.

48914 **APTIC NO. 70823**

Johnson, Orville B. and Robert F. Middleton

BIG STONE PLANT: DESIGN FEATURES AND FUEL HANDLING. *Bureau of Mines Information Circ., no. 8650: 34-48, 1973. (Presented at the Technology and Use of Lignite, Bureau of Mines-University of North Dakota Symposium, Grand Forks, N. Dak., May 9-10, 1973.)*

A 440-megawatt lignite-fired electric generating plant scheduled for commercial operation by May 1, 1975 is described. Particulates generated from the burning of the 6.46% ash lignite are controlled with an electrostatic precipitator (Wheelabrator-Lurgi). The precipitator is divided into two sections, each containing two chambers with guillotine dampers in the inlet and outlet. Arrangement and sizing of the gas chambers is such that with one chamber isolated for service, the remaining three chambers can accommodate the total gas flow while maintaining at the outlet a specified particulate emission rate of 0.1 lb/million Btu or less. Eight smoke density monitors are located at the outlets of the precipitator and are used in conjunction with an outlet louver control to balance the gas flow in the system for maximum precipitator efficiency. Expected precipitator efficiency for a gas flow rate of 2,032,000 acfm is from 99.46 to 99.66%, depending on inlet and outlet loading. Precipitator ash is conveyed pneumatically to an elevated ash silo.

48915 **APTIC NO. 70873**

Kalaimannan, S.

ELECTROSTATIC PRECIPITATORS FOR LARGE PULVERISED FUEL FIRED BOILERS. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India 1973, p. 208-215. (Sept. 11-12.)*

Factors affecting the efficiency of electrostatic precipitators for removing fly ash from large pulverized fuel-fired boilers at thermal power stations are reviewed. Migration velocity in the successive stages of a precipitator is reduced by increasing fineness of the dust and by reduction in fractional migration velocity (probably due to lower dust concentration and less agglomeration in successive stages). Electrical resistivity is the most significant factor governing fly ash precipitation. The advantage of low sulfur coals is partially offset by their increased resistivity, making fly ash precipitation more difficult. Rapping is important in maintaining satisfactory efficiency by reducing the dust layer thickness on the electrodes and thus improving performance, particularly with high resistivity dust. Automatic voltage control is also important since the migration velocity is directly proportional to the operating voltage. A sufficient series of precipitator sections with independent electrical supply is another necessity if high performance is to be achieved.

48916 **APTIC NO. 71249**

Kalen, B. and F. A. Zenz

POLLUTION CONTROL OPERATIONS: FILTERING EFFLUENT FROM A CAT CRACKER. *Chem. Eng. Progr., 69(5):67-71, June 1973.*

A granular bed filter for reducing particulate emissions from catalytic cracking units equipped with internal cyclones is described. Each cylindrical element of the filter consists of multiple shallow beds of sand stacked vertically within two perforated concentric metal tubes. The elements are supported from a clean gas plenum within a housing in a manner similar to the arrangement of filter bags in a bag house. Particle laden gas flows downwardly through the bed-supporting screens and through the inner cylinder into the clean gas plenum to the vessel outlet nozzle, with the bulk of the filtered catalyst fines accumulating on the surface and within the interstices of the sand beds. Periodically, a pulse of blowback gas is admitted for a fraction of a second through ports provided for each element to momentarily fluidize the filter medium and clear it of accumulated fines. Field tests at an oil refinery demonstrated that employment of the filter after two stages of internal cyclones reduces catalyst losses from the stack to less than 0.02 grains/dry standard cu ft for inlet dust loadings of 0.4 grain/actual cu ft (95.6% efficiency).

48917 **APTIC NO. 70877**

Kannan, V. and B. B. Sundaresan

STUDIES ON SORBENT IMPREGNATION SYSTEMS TO CONTROL AUTO-EXHAUST POLLUTION. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India 1973, p. 275-292. 5 refs. (Sept. 11-12.)*

An experimental automobile exhaust catalyst was tested with a dynamometer-mounted Fiat 100D engine for its efficiency on converting carbon monoxide and nitrogen oxides into carbon dioxide and elemental nitrogen and oxygen, respectively. Noload CO conversion efficiencies at 1000, 2000, and 3000 rpm were 100, 37.5, and 100%, respectively. No lead NO converstion efficiencies at the same rpm levels were 18.3, 43.8, and 22.7%, respectively. Carbon monoxide conversion efficiencies with a constant load of 12 kg at 1000, 2000, and 3000 rpm were 100, 50, and 100%, respectively. Load data were not obtained for NO conversions.

48918 **APTIC NO. 70845**

Khan, I. M., G. Greeves, and C. H. T. Wang

FACTORS AFFECTING SMOKE AND GASEOUS EMISSIONS FROM DIRECT INJECTION ENGINES AND A METHOD OF CALCULATION. *Preprint, Society of Automotive Engineers, New York, 24p., 1973. 27 refs. (Presented at the Society of Automotive Engineers, International Automotive Engineering Congress, Detroit, Mich., Jan. 8-12, 1973, Paper 730169.)*

The effects of injection timing, injection rate, and air swirl on emission of smoke and gaseous pollutions from direct-injection diesel engines are reviewed, and a model is developed for calculating soot and nitric oxide formation. A retard in injection timing reduces nitric oxide; carbon monoxide is likewise reduced with retard for high injection rates. Smoke levels increase with a retard in timing up to a point beyond which further retardation reduces exhaust smoke. Smoke is also reduced by an increase in the rate of injection for a given injection timing. Hydrocarbons decrease with timing retard but increase with injection rate increases. Increased injection rate increases nitric oxide but generally decreases CO. At 1000 rpm an increase in air swirl ratio (throughout the range of 2-10) reduces smoke and CO emission, though at higher engine speeds the smoke or CO versus swirl ratio curves flatten out or turn upward at the higher end of the swirl ratio range. An increase in swirl ratio makes the smoke versus timing curve less sensitive to timing changes and retards the optimum timing for efficiency, thus limiting the loss in efficiency with retard in injection timing required to reduce NO emission. A model for the calculation of soot formation and NO concentration predicts the effects of injection timing, injection rate, fueling, air swirl ratio, and engine speed on exhsuat concentrations of these pollutants. At the present stage of developement, the model is useful for predicting trends rather than absolute values.

48919 **APTIC NO. 70832**

Kotrappa, P., S. K. Dua, D. P. Bhanti, and A. R. Sundararajan

NUCLEAR METHODS FOR AIR POLLUTION CONTROL. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 31-38. 6 refs. (Sept. 11-12.)*

Studies with an electrostatic precipitator based on radioactive ionization (gamma-ray) were performed with methylene blue and ammonium chloride test aerosols. The collecting plates of the chamber were maintained at various selected voltages, and the chamber was irradiated with a 10 curie iridium-192 source close to the aerosol entrance portion. Removal efficiencies for methylene blue aerosol at a flow velocity of 20.8 cm/sec and an electric field of 5000 volts/cm ranged from 60% at a gamma radiation level of 97 R/hr to 86.3% at 7000 R/hr. Dust loads varied from 4-30 mg/cu m. Similar efficiencies were obtained for the ammonium chloride aerosol when the collection plates were lined with aluminum mesh of about 1 mm thickness as was done for the methylene blue experiments. The use of longer collection plates (75 cm) increased the collection efficiencies to greater than 96%, a marked improvement compared to the 85% collection efficiency obtained with 20 cm long collection plates. The radioactive electrostatic precipitator has the advantage that no fragile parts are involved, resulting in minimum maintenance. Electrical power consumption is extremely low because of the absence of high voltage requirements for corona production.

48920 **APTIC NO. 71237**

Leas, Lawrence E., Robert L. Leas, and Cecil J. Johnson

POLLUTION-FREE FUELS. *(Leas Bros. Development Corp., Columbia City, Ind.) U. S. Pat. 3,769,197. 5p., Oct. 30, 1973. 4 refs. (Appl. July 9, 1971, 9 claims).*

A process for the production of desulfurized and pollution-free fuels from coal is described. Coal liquids are extracted from dried coal with a hydro-treated solvent, fractionated, and treated with hydrogen to form hydrogen sulfide, which is later removed. The coal liquids are gasified with hot carbon dioxide to form a carbon monoxide-rich gas which is then introduced to a bed of cobalt oxide. Any sulfur contaminants in the CO react with the metal to form a metal sulfide resulting in a substantially S-free CO-rich gaseous product. In alternate cycles air is introduced to the gasifier to burn the materials at a higher temperature and also introduced to the bed to regain the higher oxide form. The S therein is liberated as sulfur dioxide and sent to an S-recovery system.

48921 **APTIC NO. 70891**

Manz, Oscar E.

UTILIZATION OF LIGNITE AND SUBBITUMINOUS ASH. *Bureau of Mines Information Circ., no. 8650:204-219, 1973. 9 refs. (Presented at the Technology and Use of Lignite, Bureau of Mines-University of North Dakota Symposium, Grand Forks, N. Dak., May 9-10, 1973.)*

Research on the utilization of lignite and subbituminous fly ashes for concrete and mineral filler applications is reviewed. The compressive 90-day strength of air-entrained concrete with fly ash replacements of 10-30% vary from 2812-4689 lb/sq in. as compared with a 90-day compressive strength of 4226 lb/sq in. for concrete without fly ash. Roadbuilding applications account for the largest tonnage used to date. Road-base mixtures containing 3% hydrated lime, 3% lignite fly ash, and 94% A-7 soil produce the greatest compressive strength, the least amount of swell, and the least amount of shrinkage.

Mineral filler applications are being investigated with brick test panels composed of 65% Otter Tail lignite fly ash and 35% cyclone burner slag. Bricks made of fly ash and clay mixtures are also being tested. The total amounts of lignite and subbituminous fly ashes collected during 1972 in the United States and Canada were 550,165 and 1,912,560 tons, respectively, as compared to 30,049 and 133,288 tons utilized.

48922 **APTIC NO. 70874**

Mathur, H. B., G. S. Jha, and R. K. Bakshi

CONTROL OF PARTICULATE EMISSIONS FROM IRON AND STEEL INDUSTRY. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 223-232. (Sept. 11-12.)*

Particulate emission control in the iron and steel industry is reviewed. The processes with the highest potential for air pollution are material handling, coke making, and steel making. Emissions from stocking and handling of raw materials can be reduced by the correct use of grabs, covered tripplers, and conveyors and by damping with water sprays. Charging emissions in coke making can be reduced by installation of larry cars equipped with smoke washing devices and the use of pipeline charging of preheated coal to the coke oven. Fumes resulting from steel making can be reduced by the use of diluents (nitrogen, argon, and helium) and by the use of slag barriers. Fuming occurs only within zones where the metal is exposed directly to the atmosphere. The installation of hoods over furnaces can also be used for various processes in the steel industry include: settling chambers, inertia or centrifugal collectors, filters, wet collectors, and electrostatic precipitators. The first or primary collector is usually a mechanical collector followed by a filter or electrostatic precipitator to remove smaller material.

48923 **APTIC NO. 70840**

Mehta, Prakash

CRITERIA FOR DESIGN AND SELECTION OF AIR POLLUTION CONTROL SYSTEMS. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 111-118. (Sept. 11-12.)*

Guidelines are given for the control and dispersion of gaseous and particulate air pollutants commonly emitted by the fertilizer industry. Pollutants most frequently associated with chemical operations in fertilizer manufacturing include: sulfur oxides, carbon monoxide and dioxide, nitrogen oxides, ammonia, fluorides, and particulates. Gaseous pollutants can be removed from air streams by condensation, scrubbing, adsorption, or incineration. Vapors present in high concentration and at dew-point temperatures greater than 90 F can be removed by condensation (direct cooling or compression). Scrubbing can be used to remove pollutants at concentrations greater than 1% and soluble in water. Pollutants with molecular weights greater than the normal components of air can be removed by adsorption. Combustible vapors can be burnt in direct or catalytic units. Mists less than 10 micron and at low concentrations can be removed with electrostatic precipitators, scrubbers, high-density fibrous filters, or packed beds; while sprays greater than 10 micron in size and in concentrations greater than 1 grain/cu ft can be removed with inertia separators, coarse fibrous filters, or packed beds. Submicron particles (fumes can be cleaned from exhausts with high-energy wet collectors, electrostatic precipitators, or bag filters. Dusts between 1-10 micron can be removed with wet collectors and mechanical or inertia separators, whereas dusts greater than 10 micron can be cleaned from exhausts with settling chambers or cyclones. Effective dispersion of the final exhaust requires a stack height of at least two times the height of any surrounding obstacle. The stack should be designed to ensure that gases will escape the turbulent wake of the stack.

48924 **APTIC NO. 70834**

Mookherjee, A.

ELECTROSTATIC PRECIPITATORS IN THE INDUSTRY. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 46-57. (Sept. 11-12.)*

Industrial use of electrostatic precipitators for dust control is reviewed. Applications cited include: foundries (dust-laden exhaust gases from hot blast cupola furnaces); chemical processing plants (sulfuric acid and chlorine mist collection); the aluminum industry (cleaning of pot-room gases); power stations (pulverized-coal firing); the pulp industry (sodium sulfate recovery); lime kilns; cement mills; and the iron and steel industry (sintering, pig-iron converters, ferroalloy furnaces, and electric arc furnaces). The nature of the application along with the percentage size distribution of the dust and the dust properties will determine the range of particle sizes that escape the precipitator. Submicron dusts generally escape electrostatic precipitation; dusts in the 1-5 micron region also escape but to a much lesser extent.

48925 **APTIC NO. 70818**

Moore, Calvin S.

THE COST EFFECTIVENESS OF VARIOUS ROUTES TO AUTOMOTIVE POLLUTION CONTROL. *Preprint, American Inst. of Chemical Engineers, New York, 30p., 1973. 31 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 74th, New Orleans, La., March 12, 1973.)*

Inflation, increasing competition for funds, and declining natural resources make efficient use of available funds and resources critical. A proper cost-effectiveness approach helps assure the desired result. The benefits and economy that can be achieved by meeting reasonably attainable automotive emission levels versus standards set without regard to cost or practicality are discussed. Four automotive pollution control systems are discussed and their costs and performance compared -- lean thermal reactor, lean thermal reactor plus exhaust gas recirculation (EGR), rich thermal reactor plus EGR, and low-grade rich thermal reactor plus EGR plus dual catalytic converter. The lean thermal reactor (LTR) system appears to be the most cost effective route to further improvement in automotive pollution control. The use of the LTR plus EGR rather than low-grade rich thermal reactor plus EGR plus dual catalytic converter would result in an annual savings of 13.5 billion dollars once all cars in use are equipped. This figure does not include additional millions of dollars in research and development funds that will still be required to develop a practical system to meet the 1975-1976 Federal standards, if it can be done at all. The cost effectiveness of the LTR systems is attributed largely to the relatively low installed hardware cost, to compatibility with efficient, high-compression engines, and to low maintenance costs. The LTR systems offer the demonstrated capability to markedly reduce automotive emissions and improve air quality at a reasonable cost. Appropriate versions of these systems will probably meet the proposed 1975-1976 California standards but not the 1975-1976 Federal standards. The incremental improvement in air quality to be obtained by meeting the Federal standards is extremely small and bears an outrageously high cost. The 1975-1976 Federal standards should be replaced with less stringent, more realistic standards. (Author abstract modified)

48926 **APTIC NO. 70878**

Murthy, N. S.

DETERMINATION OF ENGINE OPERATING VARIABLES FOR MINIMUM EMISSION OF POLLUTANTS. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 314-325. 2 refs. (Sept. 11-12.)*

A single-cylinder variable compression gasoline engine was dynamometer mounted to measure the effects of air-fuel ratio, spark timing, intake manifold pressure, and compression ratio on exhaust emissions. Hydrocarbon emissions were minimized by operating the engine at lean air/fuel ratios (above 15:1), increasing the manifold pressure, decreasing the compression ratio, and advancing the spark timing. Compression ratio reduction form 7.7:1 to 6:1 at an air/fuel ratio of 13:1 resulted in a 30% decrease in exhaust hydrocarbons. Spark timing retard and lean engine operation decreased the amount of carbon monoxide emitted. Nitrogen emissions were reduced by operating the engine at rich air/fuel ratios or by lowering the peak temperature attained during the combustion cycle and by decreasing inlet manifold pressure.

48927 **APTIC NO. 70361**

Nishiwaki, Mitsuru, and Kenichi Tachikawa

TREATMENT OF POULTRY EXCREMENT Y DEODORIZER AND FERMENTING AGENT SANPAT. *(Dasshu hakkozai sanpatto no keifun ni taisuru koka shiken). Text in Japanese. Tokyo Nogyo Daigaku Nojo Hokoku (ull. Univ. Farm, Tokyo Univ. Agr.), no. 1, p. 47-52, Dec. 1973. 5 refs.*

Sanpat, which consisted of yeast, enzyme, other fermenting agents, and silicate, was used for the deodorization and drying of soft poultry excrement discharged from the rainy season to mid-summer. The poultry house was divided into three areas, and 1260 and 2100 g of Sanpat were spread in two areas 2 and 3. The amounts of Sanpat were equavalent to 3% and 5% of total excrement from 48 female Leghorns in 7 days. The mixtures were transfered to a house convered with vinyl cloth, and the moisture contents were determined. Moisture content decreased as the amount of Sanpat increased, and there was no apparent humidity or temperature effect on the dehydration. Maggots were not found in the treated areas. The odors in these areas were also less unpleanant. The treated excrements were smaller in size and easier to handle as a fertilizer.

48928 **APTIC NO. 70826**

Pelleu, G. B., Jr., R. F. Berry, and N. G. Holleman

OZONE AND GLYCOL VAPOR DECONTAMINATION OF AIR IN A CLOSED ROOM. *National Naval Medical Center, Bethesda, Md., Naval Graduate Dental School, Work Unit Mr041.20.02-6050B3II, Rept. NGDS-TR-024, 13p., July 1, 1973. 25 refs.*

NTIS, DDC: AD774526

A dielectric type ozone generator and two commercial glycol-type spray decontaminants (Ozium and Air-Fresh) were evaluated in a 700 cu ft closed room for their effectiveness in reducing the number of airborne Streptococcus mitis, Staphylococcus epidermidis, and Bacillus subtillis spores. Ozone concentrations of 1.0 ppm reduced the number of streptococci and staphylococci by more than 90% within 5 min. No airborne reductions were observed at the threshold limit value for ozone (0.1 ppm). Ozium disinfectant (3 g) and Air-Fresh disinfectant (9 g) resulted in mean microbial reductions of 46 and 53% for S. mitis, 60 and 28% for S. epidermidis, and 0% for B. subtilis spores after 10 min. The effects of these glycol aerosols over 60-minute period were not significantly different from those for water aerosol controls.

48929 **APTIC NO. 70880**

Pundir, B. P., N. V. Iyer, and P. K. Goel

AN APPROACH TO VEHICLE EMISSION CONTROL IN INDIA. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 293-313. 20 refs. (Sept. 11-12.)*

Recommendations for vehicle emission control in India are outlined. The enforcement of regulations limiting idle carbon monoxide emission rates is urged as an initial step in CO emissions reduction. Control of crankcase and evaporative emissions are recommended for reducing hydrocarbon emissions; control measures for exhaust hydrocarbon emission are not urged until shown necessary. Nitrogen oxide controls are not recommended at present since such controls are expensive and complex. Removal of lead from gasoline is not viewed necessary since the lead used in gasoline in India constitutes only a small portion of the total annual consumption and since sophisticated devices such as the catalytic converter are not likely to be used in the near future. Vehicles powered by small two-stroke gasoline engines are recommended for inclusion in any hydrocarbon emission control program if the need for such a program arises. Smoke standards are recommended for diesel engines along with the possible use of fuel additives for smoke suppresion. Consideration of the diesel engine as a relatively pollution free power plant for future vehicles is urged.

48930 **APTIC NO. 70897**

Raman, M. C.

SOME ASPECTS OF ATMOSPHERIC POLLUTION AT GORAKHPUR FERTILIZER FACTORY. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 264-267. (Sept. 11-12.)*

Sources of air pollutants and measures for their control are outlined for a fertilizer factory producing 543.5 tons/day of prilled urea and 350 tons/day of liquid ammonia. Atmospheric pollution from the steam generation plant is not a serious problem and the only control measure used is a particulate collector for reducing flue-gas dust from 0.2-0.4 g/cu m to 0.032 g/cu m. Sulfur from from a coal-fed boiler (0.4-0.5% sulfur) escapes to the atmosphere with the other flue gases as sulfur oxides at a concentration of 50-70 ppm. Release of naphtha from storage tanks appears to be small. Carbon monoxide from the gasification section is flared before being released to the atmosphere. Ammonia leaks from charge pumps are prevented with teflon rings substituted for O-rings, and the charge pumps are located in a well-ventilated room.

48931 **APTIC NO. 70935**

Schotte, William

CATALYTIC REMOVAL OF SO2 IN A CARBON BED. *Preprint, American Inst. of Chemical Engineers, New York, 26p., 1973 (?). 7 refs.*

An efficient activated-carbon bed process for the removal of sulfur dioxide from gas streams was developed and tested. The use of hydriodic acid (75 ppm iodide ion) as a co-catalyst permitted the continuous removal of at least 92% of the SO2 when the feed gas contained [illegible] ppm SO2. Constant production of 28% sulfuric acid was demonstrated. Intermittent washing of the carbon for regeneration was performed while SO2 removal continued. During the period when the carbon was wet, stored iodine helped to convert SO2 to H2SO4 when oxygen mass transfer became limited. This reaction permitted operation at a relatively high space velocity of 1410/hr which is three times that used in similar carbon-bed processes. A partial life study showed no deactivation of the bed during 2275 hr of laboratory operation. The process appeared to be best suited for the removal of SO2 from sulfuric acid plant tail gas that is dust-free and contains up to 3500 ppm SO2. (Author conclusions modified)

48932 **APTIC NO. 70871**

Shah, K. T. and B. K. Gandhi

AIR POLLUTION BY THERMAL POWER STATIONS AND METHODS OF THEIR CONTROL. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut Control Tech., India, 1973, p. 181-207. 11 refs. (Sept. 11-12.)*

Air pollution control measures for thermal power stations in India are reviewed. Particulates emissions can be controlled by using fuels with low ash content, improving combustion efficiency, and stack gas cleaning (dust collectors, electrostatic precipitators, bag filters, and gas scrubbers). Switching to low-ash coals, however, is not feasible since utilities tend to use lower grade coals. Operating experience with electrostatic precipitators indicates that efficiency drops considerably with increased gas velocity, lower gas temperature, or lower sulfur content of the fuel. Corrosion and ash build-up are problems associated with mechanical dust collectors. Sulfur oxides (sulfur dioxide and sulfur trioxide) can be controlled by the use of tall stacks (dispersion), switching to low sulfur fuels, hydrodesulfurization of fuel oil, coal desulfurization, solvent refining of coal, coal gasification, fluidized-bed combustion, stack-gas scrubbing, reduction to elemental sulfur, and adsorption. Most of these are still if the stage of research and development. Wet scrubbing is the absorption process nearest to demonstrated commercial applicability. Nitrogen oxides (nitric oxide and nitrogen dioxide) can be controlled by burning natural gas or oil rather than coal since it is possible to limit the excess and flame temperatures with the first two fuels. Gas recirculation and two-stage combustion are effectively used with gas/oil fired units.

48933 **APTIC NO. 70438**

Shaver, Robert G.

A SOLVENT-REFINED COAL PROCESS FOR CLEAN UTILITY FUEL. *Advan. Chem. Ser., vol. 127:80-90, 1973. 6 refs.*

Solvent-refined coal as a de-ashed, low-sulfur fuel for electric utilities is discussed from the standpoint of economics. The lowest overall delivered cost of solvent- refined coal results from processing at minehead sites because of minimized transportation costs of the ash and sulfur fractions that are eventually removed by the processing. A potential market of 300-800 million tons per year of solvent-refined coal by 1990 is projected on the basis of the competitive price of delivered Btus from low- sulfur fossil fuels and synthetic fuels at the various power-generating sites in the U. S. Solvent-refined coal can be supplied in either a liquid or a solid form; therefore it is a potentially versatile competitor for the low-sulfur, fossil-fuel power generation market. (Author abstract)

48934 **APTIC NO. 70881**

Singh, V. D.

AIR POLLUTION CONTROL TECHNIQUES IN AN OIL REFINERY. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973. p. 242-250. (Sept. 11-12.)*

Techniques for the reduction of sulfur dioxide, hydrocarbon, carbon monoxide, particulate, and odorous emissions from oil refineries are reviewed. Sulfur dioxide can be reduced by the use of tall stacks (dispersion), restriction of fuel sulfur content, fuel oil hydrodesulfurization, and various stack cleaning processes (absorption and adsorption). Hydrocarbon vapor loss from fixed roof tanks can be reduced by the provision of floating roof tanks and the flaring of vapors released during emergencies. Carbon monoxide released from catalytic cracking unit regenerator units can be converted to carbon dioxide in a CO boiler, (oxidation) with the heat being utilized for raising steam. Odorous materials such as hydrogen sulfide and mercaptans can be minimized by extraction with caustic solution and subsequent flaring after the caustic is stripped or by burning in a separate furnace. Substantial amounts of H2S produced by hydrodesulfurization or hydrotreating processes can be sent to a sulfur recovery unit (reduction). Particulate matter from catalytic cracking units can be removed by cyclone separators.

48935 **APTIC NO. 71190**

Solomon, Lee H.

THE IMPACT OF AUTOMOTIVE EMISSION STANDARDS ON NATIONAL ENVIRONMENTAL AND ENERGY POLICY OBJECTIVES. *Preprint, American Inst. of Chemical Engineers, New York, 26p., 1973. 3 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 74th, New Orleans, La., March 12, 1973, Paper 1b.)*

The environmental impacts and related commitments of resources which may result from the implementation of competitive automotive emission control systems are evaluated. The effect of primary automotive emissions, the secondary impact of alternative control methods, and the irretrievable commitment of resources are discussed. Future environmental conditions resulting from the continued use of motor vehicles having the same characteristics as 1970 model automobiles in terms of fuel economy, emission levels, and automotive costs were projected. Mathematical models of petroleum refineries were then constructed to simulate industry investment and growth patterns. The industry raw material requirements were then determined for each of the years studied. The level of refining activity and the transportation requirements which are imposed in the reference schedule were used to determine the environmental setting which would exist in the absence of automotive emission standards more severe than those imposed on the 1970 model year. The automotive emission control systems studied were a reference system based on 1970 automobiles, a noble metal catalyst system, and basic thermal reactors. The effects of these systems on emissions, resources, and costs were determined. The strategy employing basic thermal reactors and retrofit controls for pre-1972 automobiles will result in more environmental benefits for the decade, including reduced emissions and reduced resource consumption. Noble metal catalyst systems would produce a lower direct automotive emission discharge in 1985, but have worse secondary emission effects and greater use of resources. Thermal reactors would meet Federal standards under the same time frame as catalyst systems and are based on presently available technology.

48936 **APTIC NO. 70879**

Srinivasa Rao, P., A. P. Sarathy, K. V. Gopalakrishnan, and B. S. Murthy

CONTROL OF ENGINE EXHAUST EMISSION. *Central Labour Inst., Sion, Bombay (India), Proc. Semin. Air Pollut. Control Tech. India, 1973, p. 326-329. (Sept. 11-12.)*

Experiments with spark-ignition, stratified-charge, and diesel engines were performed to investigate the effects of various engine operation and design modifications on exhaust emissions. Preheating of the fuel mixture to 45 C resulted in a 42.2% reduction in hydrocarbon and carbon monoxide emissions from a spark-ignition engine as a result of better mixture distribution. Lean mixtures of about 17:1 (air/fuel) could be used without misfiring and torque surging at this mixture preheating condition. The overall air/fuel ratio considerably influenced the degree of afterburning of hydrocarbons in the exhaust system. Experiments with a stratified charge engine (modified from a single-cylinder diesel engine) showed that the engine could run stably with mixtures as lean as 30:1. Frequent injector and pump reconditioning helped in controlling smoke emissions from diesel-powered buses. Addition of 0.25% lubrizol 565 to the fuel was effective in reducing diesel smoke emissions.

48937 **APTIC NO. 70837**

Svensson, H.

THE WORKING PRINCIPLES AND LIMITATIONS OF DIFFERENT DUST CONTROL EQUIPMENTS. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 73-89. (Sept. 11-12.)*

The principles and limitations of various types of dust control equipment are reviewed. The cyclone is the most universal separator available but its efficiency is limited (less than 85%) for particles less than 10 micron. Fabric filters, wet separators, or electric precipitators must be used to separate dust particles less than 5 micron with a collecting efficiency of more than 90%. Bag filters, although extremely efficient, are associated with a relatively high investment cost and require much space and maintenance. The gas stream must be dry to avoid the risk of condensation inside the bag filter and resultant clogging. Electrostatic precipitators can be used for the separation of particles between 0.1 and 100 micron in size at gas temperatures up to 500 C, and there is no limit on collection efficiency if consideration is not given to plant size and investment cost. Wet scrubbers are an alternative to precipitators if more importance is given to low investment cost. Scrubbers can be used for cleaning solid, liquid, or gaseous components at temperatures up to 300 C. Venturi separators can achieve high collection efficiencies with dusts as fine as 0.5 micron.

48938 **APTIC NO. 70841**

Virupakshiah, R. and K. B. Agrawal

AIR POLLUTION AND ITS CONTROL IN INDUSTRIES. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 119-125. (Sept. 11-12.)*

Various types of air pollution control equipment are reviewed in relation to reduction of gaseous and particulate emissions from specific industrial sources. The electrostatic precipitator is the most efficient and versatile control method available, with efficiencies of 99.9% achievable under practical conditions. Industrial applications include thermal power stations where large gas volumes must be handled, paper mills (soda ash recovery), cement plants (kiln gases), and steel plants (sintering plant gases, coke oven plant gases, and open hearth furnace gases). Mechanical collectors are effective only for particle sizes over 10 micron, with efficiencies of 80-85% usually being obtained. These can be used in combination with electrostatic precipitators at steam plants. Scrubbers remove both gaseous and particulate contaminants at a relatively high efficiency, though at relatively low volumes. These can be used for open hearth furnace cleaning, followed by a mist eliminator. Fabric filters also offer very high efficiency (99%); though unlike scrubbers, they cannot be employed for streams of high moisture content. Operation must always be above the dew point. Temperatures must be low, and the volume handled is relatively low compared to electrostatic precipitators. These are generally used in cement mills based on their low cost.

1972

48939 **APTIC NO. 70864**

Gleason, Robert J. and Frank Heacock

LIMESTONE WET SCRUBBING OF SULFUR DIOXIDE FROM POWER GENERATION FLUE GAS FOR HIGH AND LOW SULFUR FUELS. *Preprint, American Chemical Society, Washington, D. C., 18p., 1972. 6 refs. (Presented at the American Chemical Society, National Meeting, 164th, New York, Aug. 27-Sept. 1, 1972, Paper 26.)*

The use of limestone wet scrubbing is described as the most valuable process approach for sulfur dioxide emission control on coal-fired power generation boilers. Systems under development have been concerned primarily with operational reliability. Sulfur dioxide absorption efficiency has been given secondary treatment. Pilot plant studies on high and low- sulfur fuels using packed tower absorbers have shown that the inlet SO2 concentration and slurry composition are significant factors in the removal efficiency and operational reliability. Mass transfer coefficients have been developed for a wetted film packing. Variable height packed absorbers can provide high absorption efficiency for both high and low sulfur fuels. Hence, compliance with state and Federal regulations can be achieved even in the extreme low-sulfur coal conditions. The mass transfer coefficients measured with low-sulfur coal for both limestone and sodium hydroxide are the same. In a packed tower, limestone will absorb and react with SO2 to the same extent as a storng alkali for flue gas concentrations of less than 1000 ppm. For both high-and low-sulfur fuels, the limestone stoichiometric feed allows control of the outlet SO2 emission. Packed towers allow flexible control of the SO2 emission. Mass transfer for high-sulfur coal applications is liquid phase resistant; the contact time and high surface exposure allowed in a packed tower reduces this adverse condition. Limestone grind affects the absorption significantly at SO2 concentrations above 1000 ppm. High absorption, 95%, can be achieved with an 89%-325 mesh material at 1300 ppm. (Author conclusions)

48940 **APTIC NO. 70437**

Hawthorn, R. D.

AFTERBURNER CATALYSTS--EFFECTS OF HEAT AND MASS TRANSFER BETWEEN GAS AND CATALYST SURFACE. *AIChE Symp. Ser., 70(137): 428-438, 1972 (?). 15 refs.*

Extremely high reaction rates and novel matrix shapes for catalyst supports distinguish catalytic afterburning from conventional applications of heterogeneous catalysts. A model developed for the process takes into account both gas- to-catalyst transport processes and chemical processes within the catalyst. Correlations for transport coefficients for matrix catalysts are presented. The calculation procedure can be used to specify catalyst volume and geometry for the types of matrix supports in current use in afterburners. Several commercially available catalysts, the mechanisms and rates of reactions in afterburner catalysts, and mass transfer coefficients are discussed. (Author abstract modified)

48941 **APTIC NO. 70393**

Lapedes, D. E., M. G. Hinton, Toru Iura, and Joseph Meltzer

ASSESSMENT OF DOMESTIC AUTOMOTIVE INDUSTRY PRODUCTION LEAD TIME OF 1975/76 MODEL YEAR: VOLUME II - TECHNICAL DISCUSSION FINAL REPORT. *Aerospace Corp., El Segundo, Calif., Office of Air and Waste Management Contract 68-01-0417, Rept. EPA-460/3-74-026-b, ATR-73(7321)-1, 374p., Dec. 1972. 68 refs.*

The emission control systems and system components proposed by the major domestic automobile manufacturers for use in their 1975/1976 light-duty vehicles are described. All first choice systems incorporate an oxidation catalyst with air injection to promote the oxidation of the unburned hydrocarbons and carbon monoxide in the engine exhaust. The preferred catalyst type is the platinum-group metal/monolithic converter. Exhaust gas recirculation (EGR) systems will be in nearly all 1975 cars. Some emission control systems ill use a partial thermal reactor in place of the conventional exhaust manifold primarily to provide more rapid warmup of the catalyst under cold start conditions. Emission control systems under consideration for 1976 model cars will incorporate all components in the 1975 system plus reduction catalyst(s) installed upstream of the oxidation catalyst(s), more sophisticated air injection systems, and modified carburetion, ignition, and EGR systems.

48942 **APTIC NO. 70465**

Schoenherr, Roman, James A. Woolley, and Wing Chow

CERAMIC MONOLITHS AS CATALYST SUPPORTS FOR EMISSION CONTROL APPLICATIONS. *Preprint, 29p., 1972 (?). 3 refs.*

A comparison of the overall effectiveness of various monolith designs for catalytic converters as modeled by finite difference techniques are discussed on the basis of three criteria: the relative thermal response as a function of geometry; the contribution of the entrance region; and the heat flux distribution at the channel wall. The finite difference modeling of the thermal response of monolithic ceramic catalyst supports with circular, square, sinusoidal, and rectangular channels shows that based on channels with cross-sectional area equal to that of ThermaComb 795-8/8, a monolith with four to one rectangular channels would give the best performance, but based on current technology, square cell monoliths would be preferred, i.e., less volume of monolith would be required to get the same performance; of the monoliths currently available from the Technical Ceramic Products Division of 3M, the performance improves in going from 200 cell/square in. square cell to 8/8 sinusoidal to 400 cell/square in. square cell to 12/6 sinusoidal with a slight increase in pressure drop, i.e., the 12/6 sinusoidal monoliths would require the least volume to get the same performance. An analysis of the contribution of the entrance region of ceramic monoliths to thermal response has shown it to be significant and implies that 25% reductions in monolith volume could be realized by using multiple short sections of monoliths. (Author summary)

1971

48943 **APTIC NO. 71230**

Chia, C. J.

MERCURY REMOVAL FROM CHLORALKALI PLANT EFFLUENTS. *Preprint, 20p., 1971. 5 refs. (Presented at the Canadian Chemical Engineering Conference, 21st, Montreal, Quebec, Oct. 15, 1971.)*

A continuous process to remove mercury from liquid effluents of chlor-alkali plants was developed from the laboratory to the pilot plant stage to the full-scale treatment plant at Canadian Industries Limited (CIL). The process is based on the precipitation of mercury as insoluble mercuric sulfide under controlled pH conditions, followed by settling and filtration of the precipitates. The mercury level in the treated effluent is intended to be less than 0.1 ppm. The first full-scale treatment plant, with a design capacity of 15 gpm, has been in operation since Dec. 1, 1970 at the CIL Cornwall Works. The mercury levels in the treated effluent is typically about 0.2 ppm after a sand filter and below 0.05 ppm after a polishing charcoal filter. Mercury removal plants based on the sulfide precipitation process are being installed at all CIL chlor-alkali plants and at other plants under CIL management. Different phases in the development of the CIL mercury removal process for liquid effluents, the performance and operating data of the Cornwall plant, and the preliminary experience available from other locations are discussed. The removal of mercury from gases, the recovery of mercury from solids, and the measuring techniques for mercury are also reviewed. Mercury can be removed from gases by activated carbon adsorption; mercury vapor can be measured by ultraviolet light absorption. (Author abstract modified)

48944 **APTIC NO. 71196**

CHEM Systems, Inc., New York

DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME I. ENGINEERING STUDIES. PART 2. COG REFINERY ECONOMIC EVALUATION. PHASE I. (INTERIM REPORT). *Office of Coal Research Contract 14-01-0001-496, Pittsburgh and Midway Coal Mining Company Rept., Rept. OCR-53-3, SRC Process Rept., 67p., April 1971. 18 refs.*

NTIS: PB 234041

The process flow sequence and economics for a COG (coal, oil, gas) refinery that produces high BTU pipeline gas and liquids suitable as feedstock for a petroleum refinery are described. The refinery combines solvent refining with other complementary processes to produce an ashless, low-sulfur, heavy liquid designated as solvent refined coal. This product is upgraded by hydrocracking, and hydrotreating to produce light liquids for feedstock. The hydrogen requirement for these steps is satisfied by gasification of coal to synthesis gas. Methane is also produced in this step. The synthesis gas is shifted to yield hydrogen, while the methane is separated from hydrogen for pipeline gas. The most promising COG refinery design uses the Bituminous Coal Research oxygen-blown Bi-Gas process for the coal gasification. Hydrocracking of the solvent refined coal and subsequent hydrotreating are common to each of the alternate process combinations evaluated. For a coal feed rate of 58,600 tons/day, the major products from the COG refinery are 100,000 barrels/day of light refinery liquids and 366,000,000 standard cu ft/day of pipeline gas. The ability to produce pipeline gas in this manner is significant since there is presently no commercial methanation process for raising low BTU gas to the 1000 BTU/standard cu ft level. The latter is also likely to prove relatively expensive.

1969

48945 **APTIC NO. 70436**

Hemsath, Klaus H. and Peter E. Susey

FUME INCINERATION KINETICS AND ITS APPLICATIONS. *AIChE Symp. Ser., 70(137):439-449, 1969 (?). 6 refs.*

The kinetics of the oxidation process were studied experimentally to develop information useful in designing equipment that will efficiently control the emission of hydrocarbons, carbon monoxide, and smoke. Extensive measurements on the oxidation kinetics of some characteristic hydrocarbons were made in a specially designed reactor that allowed the kinetics to be determined under turbulent flow conditions with radially uniform distributions of temperatures and concentrations. Typical test results and kinetic data are reported. The application of this kinetic information to the actual design of thermal fume incineration equipment is discussed. The influence of proper mixing on incineration efficiency and incineration economics is evaluated and cold model mixing tests that resulted in a patented low pressure drop mixing device are described. Actual applications of different thermal incineration equipment designs are evaluated, and recommendations based on actual field experience are made for the selection of fume incineration equipment. (Author abstract modified)

1968

48946 **APTIC NO. 71238**

Lucas, Robert L. and Harold F. Porter

PROCESS AND APPARATUS FOR WET SCRUB REMOVAL OF DUST AND MIST FROM GASES. *(du Pont de Nemours (E. I.) and Co., Wilmington, Del.) U. S. Pat. 3,370,401. 7p., Feb. 27, 1968. 8 refs. (Appl. Feb. 1, 1967, 2 claims).*

A process and apparatus for the wet scrubbing removal of dust and mist from gases were developed. The polluted gas is sprayed with a liquid in which the dust is relatively insoluble. The gas and liquid are then passed at a velocity in excess of the flooding velocity through a fibrous bed. The dust and mist are contacted with the liquid and separated as a liquid slurry. The cleansed gas is withdrawn as a separate fraction. (Author abstract modified)

MEASUREMENT METHODS

1975

48947 **APTIC NO. 71185**

Black, Francis M., Larry E. High, and John E. Sigsby

A GAS CHROMATOGRAPHIC METHOD FOR DIRECT ANALYSIS OF PHOTOCHEMICALLY NONREACTIVE HYDROCARBONS. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, 23p., 1975. 8 refs.*

An automated gas chromatographic system for the direct analysis of the photochemically nonreactive hydrocarbons methane, ethane, propane, acetylene, and benzene is described. These compounds are relatively nonreactive in the formation of photochemical oxidant/ozone and can be determined in the presence of any other gas-phase organic or inorganic material found in source emissions. A single sample analysis can be completed in about 14.5 min. and system turnaround time is about 28 min. The system is multi-column due to the varying nature of the compounds being determined and to the wide variety of potentially interfering compounds found in samples of interest. A valve programmer is described which will reproducibly sequence the analysis unattended. (Author summary modified)

48948 **APTIC NO. 70993**

Camuffo, Dario

A SIMPLE DEVICE FOR PRELIMINARY STUDIES ON AIR POLLUTION DYNAMICS. *Atmos. Environ., 9(2):265-266, Feb. 1975. 2 refs.*

A simplified data acquisition procedure for correlating wind rose with sulfur dioxide concentration is described. The method is based on a color-coded correlation between wind direction and pollutant concentration. This is automatically obtained on a single strip-chart of a multipoint recorder by changing the color in the record of pollutant concentration whenever the wind changes direction. Thus, the wind rose is divided into sectors, each with a characteristic color. The data acquisition system consists of a continuous gas monitoring apparatus and a multichannel recorder that is driven by a correlating unit. The latter is a wind vane with two brush type contacts spaced 45 deg apart and travelling on four conducting sectors, each corresponding to 90 deg of wind direction. Each contact is connected with one channel of a four channel multipoint recorder. In operation, the gas monitoring equipment supplies a tension proportional to the pollutant concentration, and the wind vane enables only one or two channels of the recorder to receive the signal.

48949 **APTIC NO. 70798**

De Souza, T. L. C., D. C. Lane, and S. P. hatia

ANALYSIS OF SULFUR-CONTAINING GASES Y GAS-SOLID CHROMATOGRAPHY ON A SPECIALLY TREATED PORAPAK QS COLUMN PACKING. *Anal. Chem., 47(3):543-545, March 1975. 8 refs.*

A gas-solid chromatographic method for the analysis of gases containing sulfur compounds in the parts per million range is described. The analytical system basically consists of a dual column gas chromatograph, a flame photometric detector, and a specially chromatograph, a flame photometric detector, and a specially treated Porapak column. The column is an acetone-washed Teflon tube (1/8 in. outside diameter and 18 in. long) packed with 80/100 mesh acetone-washed Porapak QS. A 2-cu cm stainless steel sampling valve, connected to a vacuum and a mercury manometer, is used to introduce the sample into the column at a constant absolute pressure of 20 cm mercury. Retention times for a standard sample containing hydrogen sulfide, carbonyl sulfide, sulfur dioxide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide are 77, 108, 182, 213, 270, and 361 sec, respectively. Conditioning of the column with two or three injections of concentrated gas mixtures, followed by temperature programming to 240 C, helps to stabilize the column. Retention data are very consistent since there is no liquid phase lost via continual bleeding. The method is inexpensive and offers high resolution in comparison with other chromatographic methods used for the analysis of mixtures of sulfur compounds.

48950 **APTIC NO. 71433**

Friedrichs, Karl-Heinz

THE MEASUREMENT OF FIBROUS DUSTS IN AMBIENT AIR. *(Die Messung faserfoermiger Staeube in der Aussenluft). Text in German. Staub, Reinhaltung Luft, 35(2):54-56, Feb. 1975. 12 refs.*

At present there were no uniform methods for sampling and estimation of fibrous particles in the air. The estimation of fiber content can only be made by counting methods. The results of measurements made in two Ruhr district cities in 1973 are presented. Sampling was by Nuclepore and membrane filters and counting was done by light microscopy (phase contrast and polarization optics). The fiber concentration in ambient air was between 650 and 6500/cu m. The limitations of light microscopy make it necessary to rely on electron microscopic techniques.

48951 **APTIC NO. 70751**

Fujimura, Mitsuru and Yoshikazu Hashimoto

ANALYSIS OF SIZE DISTRIUTION DATA OF PARTICULATE MATTER Y AN ANDERSEN SAMPLER. *(Andasen sampura ni yoru earozoru no ryudo bynpu no kaiseki). Text in Japanese. unseki Kagaku (Japan Analyst), 24(1):36-41, Jan. 1975. 6 refs.*

A method for analyzing the size distribution of particulate matter collected with an Andersen sampler is described. A cumulative distribution curve is drawn on semi-logarithmic graph paper, using cumulative weight percentages. A frequency distribution curve is then obtained by differentiating the cumulative distribution curve with respect to the log of the distribution. The frequency distribution curve obtained can be treated quantitatively to obtain the size distribution spectrum of the aerosol. Application of the size distribution curve to an aerosol sample analyzed by atomic absorption spectrometry resulted in a peak for iron around 4 micron and a peak for zinc around 0.9 micron.

48952 **APTIC NO. 70626**

Ichinose, Masaomi

AUTOMATIC GAS SAMPLER. *(Jido gasu saishu sochi). Text in Japanese. (Gifu Aichi Electric Co., Ltd. (Japan)) Japan. Pat. Sho 50-2114. 5p., Jan. 23, 1975. (Appl. Jan. 22, 1969, 1 claim).*

An automatic gas sampler consists of a sampling bottle with an impinger, control valve, surge tank, flowmeter (bypassed during sampling), surge tank, flow control valve, and suction pump connected in series. The control valve is operated by a cam placed on a shaft connected to a clock mechanism which rotates with the clock movement. Six sampling bottles are connected individually to six control valves operated by six cams placed in a staggered manner. The cam may be set to open the control valve for 1 or 2 hr while the gas sample is drawn steadily through the solution in the sampling bottle by the action of the suction pump with a battery-operated motor. For gaseous samples, the sampling bag is connected to the control valve in the place of the sampling bottle, and the pipe between suction pump and flow control valve is switched to gas outlet of the suction pump from the gas inlet. The gaseous sample is drawn from the gas inlet of the suction pump and led through the system to the sampling bag. In this case, the sample gas flow in the above-mentioned system is reversed, compared to the case using the sampling bottle.

48953 **APTIC NO. 70961**

Kneebone, B. M. and H. Freiser

DETERMINATION OF CHROMIUM (VI) IN INDUSTRIAL ATMOSPHERES BY A CATALYTIC METHOD. *Anal. Chem., 47(3):595-598, March 1975. 9 refs.*

A spectrophotometric method for the determination of chromium (VI) in industrial atmospheres (chrome plating and dye plants) is described. The method is based on the catalytic oxidation of o-dianisidine by hydrogen peroxide and is applicable to filter samples containing 0-30 microgram Cr (VI). Ion-exchange treatment is used to separate major interferences such as lead (II), copper (II), chromium (III), iron (III), and vanadium (V). The sensitivity of the method is 0.001 microgram Cr (VI), and the precision ranges from + or - 10% for the blank to + or - 1-3% for Cr (VI) concentrations above 0.10 micrograms/ml and within 6% for lower concentrations. The useful range of the method (1.0-25.0 micrograms Cr (CI)/filter) can be extended by choosing appropriate wash volumes so that the concentration of CR (VI) in the reaction flask is no smaller than 0.001 microgram/ml. The use of a concentrated acid solution to dissolve lead chromate, followed by ion exchange and neutralization should make the method adaptable to the paint industry as well.

48954 **APTIC NO. 70388**

Masek, Vaclav

HARD COAL PETROGRAPHY AND MICROSCOPIC INTEGRATION ANALYSIS FOR DUST EXAMINATIONS IN A COKING PLANT AND ITS VICINITY. *(Steinkohlenpetrographie und mikroskopische Integrationsanalyse im Dienste der Staubdiagnostik in einer Kokerei und in deren Umgebung). Text in German. Staub, Reinhaltung Luft, 35(1):9-11, Jan. 1975. 1 ref.*

Microscope investigations were carried out on samples of sedimented dust and flue dust taken in a foundry coke-oven plant and its immediate surroundings during a 6-month period. Particles with ground sections prepared with polystyrene resin were used for the investigation. The sedimented dust can be characterized by the well known method of investigation based on coal petrography. In contrast to this, the samples of flue dust, and particularly their respirable portion, can in most cases be separated into material groups and determined by integration analysis only after thermal treatment of the charge coal.

48955 **APTIC NO. 71015**

McLean, James D. and John F. Holland

DEVELOPMENT OF A PORTABLE POLAROGRAPH FOR DETERMINATION OF ALDEHYDES IN AUTOMOTIVE EXHAUST AND PRODUCTION PLANT SAMPLES. *Environ. Sci. Technol., 9(2):127-131, Feb. 1975. 4 refs.*

A portable polarograph for the determination of aldehydes in ambient air, automotive exhaust, and plant process streams is described that overcomes prior art limitations of complexity and fragility with no sacrifice in sensitivity and accuracy. The basic instrument package is constructed with solid-state electronics and weighs about 10 lb. A direct digital readout replaces the conventional strip chart recorder. Scan time is reduced to 1 min. A small hanging mercury drop electrode with a self-contained mercury supply replaces the conventional dropping mercury electrode with its cumbersome reservoir and stand tube. Response curves for formaldehyde standards indicate that linearity is good up to 40 micrograms of formaldehyde. Sensitivity is sufficient to allow the determination of as little as 1 ppm formaldehyde. Excellent results can be obtained for samples containing primarily one aldehyde component.

48956 **APTIC NO. 71436**

Ogata, Masana, Hiroko Asahara, and Takao Saeki

SAMPLING AND ANALYSIS OF SOME AROMATIC, ALIPHATIC AND CHLORINATED HYDROCARBON VAPORS IN AIR, A GAS-LIQUID CHROMATOGRAPHIC AND COLORIMETRIC METHOD. *Int. Arch. Arbeitsmed., 34(1):25-37, 1975. 13 refs.*

Methods for the sampling of air and analysis for mixtures of organic solvent vapors by personal and room air samplers are described. The application of potassium carbonate to remove water vapor and silica gel adsorption tube cooled by dry ice for collection of organic solvents were investigated. Organic solvents were successfully extracted from silica gel by cumene, ethyl ether, pyridine, and dimethyl sulfoxide and subsequently estimated by gas chromatography or colorimetry. This method was particularly useful for the personal air sampler. Useful absorbing agents for the room sampler include ethyl cellosolve acetate and N,N -dimethyl formamide cooled by ice.

48957 **APTIC NO. 71127**

Tanimoto, Mitsutoshi and Hiromichi Uehara

DETECTION OF ACROLEIN IN ENGINE EXHAUST WITH MICROWAVE CAVITY SPECTROMETER OF STARK VOLTAGE SWEEP TYPE. *Environ. Sci. Technol., 9(2):153-154, Feb. 1975. 7 refs.*

A microwave spectrometric method for the detection of acrolein in automobile engine exhausts is described. The microwave cavity spectrometer is of the Stark voltage sweep type and operates at a fixed frequency of 8910.5 megahertz. Exhaust gas from a dynamometer-mounted automobile engine is collected with a glass tube packed with phosphorus pentoxide and is then trapped on a cold adsorbent in a dry ice-acetone ice bath. The desorbed gas is introduced into the spectrometer cavity, and the pressure is reduced to about 20 torr. A sample of exhaust gas analyzed by this procedure contained about 5 ppm acrolein, though only about one seventh of the acrolein in the sample was recovered by the collection and trapping technique. The recovery efficiency was especially low when liquid nitrogen trapping of condensables was used. The amount of acrolein lost in each of the treatments was not determined.

1974

48958 **APTIC NO. 71143**

Amaya, K.

SIMPLE METHODS OF MEASURING AIR POLLUTANTS BY MINI SAMPLERS. *(Kogata hoshukan o mochiita shushu no taiki osen busshitsu no kani sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):192, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Mini samplers, made by inserting absorbent-impregnated filter paper in a capped plastic tube, were used for ammonia, oxidants, nitrogen dioxide, hydrogen cyanide, and sulfur dioxide determinations. The absorbents and analytical methods were as follows: NH3: 5% boric acid aqueous solution, indophenol test; oxidants: 25% triethanolamine plus 3% potassium oxide aqueous solution, alkaline KI method; NO2: 50% triethanolamine aqueous solution, Jacobs-Hochheiser method; HCN: 1% mercuric chloride aqueous solution, I2-KI method; SO2: glycerin-30% hydrogen peroxide (50/50 by volume), differential conductivity method. The mini samplers have the advantages of simple operation and the possibility of making a large number of simultaneous determinations.

48959 **APTIC NO. 71495**

Amaya, K.

A SIMPLE DIFFERENTIAL ELONGATION METHOD OF MEASURING OZONE USING RUBBER STRING. *(Gomu himo o riyoshita shisashiki ozone kani sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):194, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.*

A simple way of detecting ozone in air by using rubber was developed. Two rubber rings were held on one end with a gem clip and on each of the other ends with hooks. Rubber ring 1 was wrapped with tape to keep it from contacting ozone whereas rubber ring 2 was exposed to gas containing ozone. Double bonds in the structure of the rubber are opened by ozone, which causes displacements of the molecules. The displacement of the gem clip at the center was measured by a pre-arranged scale. The degree of the displacement semi-quantitatively corresponds to the ozone concentration.

48960 **APTIC NO. 71115**

Anderson, Richard D., Nicolas A. Azelborn, and Wallace R. Wade

CRITICAL FLOW VENTURI. *(Ford Motor Co., Dearborn, Mich.) U. S. Pat. 3,817,100. 6p., June 18, 1974. 1 ref. (Appl. Nov. 3, 1972, 8 claims).*

An apparatus for determining the total mass of exhaust gas constituents emitted from an engine is described that is capable of functioning with high-volume systems such as gas turbine engines as well as low-volume systems such as reciprocating engines. High-volume flows are not suitably handled by prior-art constant-volume sampling devices. The apparatus extracts a truly proportional flow sample from a thru-duct receiving both exhaust gases and dilution air. Proportionality is obtained by providing a choked flow restriction (critical flow venturi) which creates a zone of known flow conditions for total mixed flow. A sampling apparatus is adapted to extract a small portion of the flow within this zone through a similar choked venturi to complete the proportionality and identity of inlet flow conditions. Thus, pressure and temperature vary in absolutely the same way for the inlets to the sampling venturi and total mixed flow venturi. The total mass of the exhaust gas from the engine is determined from measurements of total mixed flow, total dilution air flow, concentration of dilution air constituents, and concentration of gaseous constituents in the mixed flow.

48961 **APTIC NO. 70927**

Anikeyev, V. A., V. P. Bugayev, V. A. Limanskiy, Y. N. Andrusenko, and V. Y. Padva

TECHNOLOGY OF PARTICULATE SAMPLING FROM REACTIVE, DAMP, AND HIGH-TEMPERATURE GASES. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 695-708. 3 refs. (Jan. 15-18, Paper 29.)*

Devices for sampling particulates from high-temperature gaseous streams containing moisture and/or reactive species are described. Depending on the particular application, filter materials made of teflon, metalloceramics, and ceramics other than glass are used in the samplers. A cassette-type of sampler is used to decrease sampling time. Spray concentrations of up to 5 g/cu nm and particulate concentrations of up to 10 g/cu nm can be determined simultaneously or individually. The filters can be regenerated with acid or alkaline treatment, with the regeneration procedure being determined experimentally each specific case. Sampling units with valve interceptors are used for sampling blast furnaces.

48962 **APTIC NO. 68897**

aumgardner, R. E., T. A. Clark, J. A. Hodgeson, and R. K. Stevens

DETERMINATION OF AN OZONE INTERFERENCE IN THE CONTINUOUS SALTZMAN NO2 PROCEDURE. *Preprint, 40p., 1974 (?) 19 refs.*

The continuous Saltzman nitrogen dioxide procedures were studied to determine whether an ozone interference exists, and to quantify the effect if present. Generation of dynamic mixtures of NO2 and O3 required in the interference tests necessitated the examination of the O3-NO2 gas phase reaction. Newly developed chemiluminescent analyzers for O3 and NO2 were used to monitor the O3-NO2 stream. There was a negative interference in both the continuous Saltzman and modified Saltzman procedures which was dependent on the absolute O3 and NO2 concentrations. The reaction of NO2 and O3 is the sample stream does not account for the decrease in NO2 response as observed by the Saltzman procedures. Ozone and NO2 data from four cities were compared and show that O3 to NO2 ratios exist in the atmosphere. Ratios higher than 1 pose a significant problem in using the continuous Saltzman or modified procedure for ambient air monitoring. (Author abstract modified)

48963 **APTIC NO. 70467**

Baker, Gary L. and Jay H. Brubaker

CALIBRATION OF A TRACE SULFUR AIR MONITOR. *Instrument Society of America, Pittsburgh, Pa., Instr. Soc. Am. Anal. Instr. Symp., Proc. 20th Annu., Pittsburgh, Pa., 1974, p. 133-138. 6 refs. (May 12-15.)*

The successful application of a trace air monitor for the measurement of compounds in the low ppb range is largely dependent on the reliability of calibration. The accuracy of any individual calibration technique at the sub-ppm level is subject to question. However, when one or more independent methods compare favorably, the level of confidence is greatly improved. The approach used at the Union Carbide Corporation for calibrating a chromatographic air monitor for hydrogen sulfide and carbon disulfide at 10 ppb full scale is described. Four different techniques were used to achieve confidence in the accuracy of calibration at this extremely low range including permeation devices, volumetric dilution, wet chemical analysis, and a combination of all three methods. Permeation devices are very useful for performing the calibration, and especially for providing easy calibration checks at any time. The permeation devices provide the only practical means of automatic calibration at low concentrations. Wet chemical analysis is a good independent method of verifying permeation parameters but requires a skilled analyst. Volumetric dilution requires another good independent calibration check. It is easier to perform the wet chemical method, and it provides immediate results. The most accurate results will be obtained by using the three methods together. The calibration accuracy of the air monitor described is believed to be within + or - 0.5 ppb at 10 ppb. (Author summary modified)

48964 **APTIC NO. 71129**

Beckett, S. T. and M. D. Attfield

INTER-LABORATORY COMPARISONS OF THE COUNTING OF ASBESTOS FIBRES SAMPLED ON MEMBRANE FILTERS. *Ann. Occupational Hyg., 17(2):85-96, 1974. 5 refs.*

Inter-laboratory comparisons of the counting of asbestos fibers sampled on membrane filters were performed. Disagreements between inexperienced laboratories were mainly due to uncertainties in the counting of irregular fibers and fiber masses, misalignment of the microscope phase rings, and failure to scan the full depth of focus. Such disagreements were reduced by direct personal consultation. The counts by inexperienced laboratories before consultation were considerably lower than the standard, being about half the standard for factory samples and one quarter for standardized chrysotile samples. Slide exchange experiments between four experienced laboratories showed chrysotile results to be more variable than those for amosite, with standard deviations of the natural log differences being 0.47 and 0.14, respectively. All variability appeared to be of random origin. Major differences (three-fold for chrysotile and one-and-a-half-fold for amosite) were observed between full field view counting and the counting of fibers only within the grid area of the eyepiece graticule, possibly due to the greater resolution of the microscope in the central (grid) area as compared with the periphery of the field. The spread of counting levels (lowest and highest ratios to the mean) for experienced laboratories using their normal (different) counting methods were 0.57 and 1.95 for chrysotile and 0.83 and 1.23 for amosite. Adoption of the same counting method reduced the spread in both cases to about half the present spread.

48965 **APTIC NO. 71460**

Bergert, K. -H. and V. Betz

ASPECTS OF THE QUANTITATIVE ANALYSIS OF VOLATILE ORGANIC MICROPOLLUTANTS IN AIR. *(Erfahrungen bei der quantitativen Analyse von fluechtigen Mikroverunreinigungen in Luft). Text in German. Chromatographia, 7(12):681-687, Dec. 1974. 11 refs.*

The reliability of gas-chromatographic quantitative determination of volatile organic micropollutants in the air is discussed on the basis of actual measurements, using semi-automatic transfer of the samples into the capillary column. The semi-automatic transfer of samples by a timer-controlled system is essential for an increase in the precision and reliability of quantitative gas chromatographic analysis. In routine analysis, retention indices can be reproduced at an accuracy of 0.3 to 0.6 units, with the standard deviation of the concentration measurements being 4.5%. Comparative concentration measurements of organic pollutants in the air of a mountainous recreational facility and a city center in its vicinity revealed pollutant concentrations up to 100 times higher in the city air.

48966 **APTIC NO. 71173**

Cain, William S. and Howard R. Moskowitz

PSYCHOPHYSICAL SCALING OF ODOR. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.), New York, Academic Press, 1974, p. 1-32. 102 refs.*

Odor itensity measurements involving psychophysical scaling are reviewed. Topics reviewed include: scales of measurement (nominal, ordinal, interval, and ratio); the construction of psychophysical scales using either indirect or direct scaling; methods for comparing scaling techniques; logarithmic and power functions for describing the relationship between perceived odor intensity and odor concentration; differences between neurophysiological recording and psychophysical judgments; procedural variables regarding regression tendency on the part of the observer; and the role of psychophysical scaling in studying the effects of adaptation, masking, and mixtures on odor perception.

48967 **APTIC NO. 70477**

Cassady, M. E., K. A. Giberti, R. S. Opalanko, and G. D. Schurtz

STATUS OF KENNECOTT COPPER CORPORATION S PARTICULATE AND SUSPENDED SULFATE PROGRAM. *Preprint, American Inst. of Chemical Engineers, New York, 16p., 1974. 65 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 78th, Salt Lake City, Utah, Aug. 18-21, 1974.*

Some attempts to develop epidemiologic data to establish the relationship, if any, between ambient sulfur dioxide concentrations and human health, and between ambient concentrations of particulate sulfate and human health, were hampered by imprecise or inadequate sampling and analytical techniques, as well as by limited understanding of the rate at which SO2 in the plume oxidizes to sulfur trioxide. These deficiencies are particularly apparent in the CHESS (Community Health and Environmental Surveillance System) studies. The same lack of knowledge has made it difficult, if not impossible, to predict the opacity of a smelter plume upon completion of a program of pollution abatement facilities installations. Because of the need to increase knowledge and understanding of plume chemistry, laboratory and field work was undertaken on monitoring and kinetics and mechanisms of SO2 oxidation in stack plumes. The deficiencies of SO2, nitrogen dioxide, suspended sulfate, suspended nitrate, total suspended particulate, and fine particulate determinations in CHESS studies, and the background levels of trace metals and sulfates and humidity effects are reviewed. Oxidation mechanisms, photochemical reactions, gaseous oxidants and catalytic aerosols, stack and plume sampling, and SO2 oxidation kinetics are discussed. (Author conclusions modified)

48968 **APTIC NO. 70458**

Chamberlain, C. Edward and Robert W. Freedman

MICRODETERMINATION OF VOLATILE MATTER AND ROCK DUST CONCENTRATION OF AIRBORNE COAL MINE DUST. *Bureau of Mines, Pittsburgh, Pa., Pittsburgh Mining and Safety Research Center, Rept. Investigations 7979, 11p., 1974. 2 refs.*

A micro-volatile procedure was developed for the analysis of volatile matter in airborne coal dust/rock dust mixtures prior to, and resulting from, coal mine fires and explosions. Dust in the 10 to 20 mg weight range can be analyzed. Volatile matter is determined by a greatly scaled-down version of the empirical macro-scale method of analysis. The alkaline earth carbonates in the rock dust are dissolved in acid prior to the volatile matter determination of the residue, and the rock dust content is calculated from the analysis of calcium and magnesium by atomic absorption. The micro-volatile method was tested on a coal dust- rock dust sample, and results were compared with those by the macro-volatile method. (Author abstract modified)

48969 **APTIC NO. 71489**

Cheng, Chin Huan and Bruce C. Peters

HYDROGEN SULFIDE MONITOR. *(Dow Chemical Co., Midland, Mich.) U. S. Pat. 3,820,958. 5p., June 28, 1974. 7 refs. (Appl. Jan. 29, 1973, 3 claims).*

An electrochemical hydrogen sulfide monitor for determining airborne H2S concentrations at low ppm levels (i.e., below the 6-40 ppm level of the lead acetate colorimetric method) is described that offers greater portability, simplicity, and sensitivity than existing methods. Silver is deposited on a thin dielectric film and then exposed to the H2S-containing gas mixture. The electrical resistance across the film before and after exposure to H2S, as well as the exposure time, are utilized to determine the amount of H2S present. An apparatus utilizing standardized films provides direct reading of H2S levels. (Author abstract modified)

48970 **APTIC NO. 70825**

Deepak, Adarsh, R. Ozarski, and J. A. L. Thomson

A STANDARD PARTICLE SIZER-VELOCIMETER. *Nasa Tech. Memo., 1974:1-53, June 1974. 2 refs. (George C. Marshall Space Flight Center, Alabama, Systems, Dynamics Lab., Aeronautics and Space Administration Contract NAS 8-24810, Rept. NASA TM X-64857.)*

NTIS: N74-28937

A particle sizer-velocimeter which provides a standard source of aerosols of known size distribution, moving with a known velocity, during the calibration of continuous wave carbon dioxide-laser Doppler velocimeters is described. The instrument consists of a laser scattering counter and a photographic system, each of which can function independently or in conjunction for simultaneous monitoring of the same sample of particles. The laser scattering counter can be easily modified to operate either as a forward-scattering particle sizer-counter or as a forward dual-beam velocimeter. The instrument has the following capabilities: size distribution monitoring of particles with diameters larger than 1.0 micron; flow velocity measurements in range of 0.05-100.0 cm/sec; photography of particles with diameters larger than 0.2 micron moving at slow speeds (about 0.1 cm/sec); and size distribution measurements of particles settling in quiet air (or air with convection velocities of less than 0.15 cm/sec). The instrument can be used either in the laboratory or in the field.

48971 **APTIC NO. 70924**

Dorsey, J. A. and D. B. Harris

THE PRESENT STATUS OF PARTICULATE MASS MEASUREMENTS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 625-640. (Jan. 15-18, Paper 26.)*

Manual and instrumental determinations of particulate mass loading in process streams before and after control equipment are discussed. Manual particulate measurements require improvement if they are to be useful for the very low concentrations normally found after high efficiency control devices. While the coefficient of variation at the 95% confidence level is about 24% at 2.0 g/cu NM, it increases to 76% at 0.02 g/cu NM, a concentration typical of the exit from control devices. Regarding instrumental methods, there are a very limited number of techniques available for monitoring thye mass concentration of particles in a process stream. The only technique reduced to practice is based on the attenuation of beta radiation by particulate collected on a filter media. Data available for coal fly ash, coal soot, cement dust, and gypsum correlate to within 10% for a given sensor, even though the attenuation of energy is somewhat dependent on the atomic number and atomic weight of the elements in the particulate matter being measured.

48972 **APTIC NO. 70675**

Eddy, David S.

PHYSICAL PRINCIPLES OF THE ZIRCONIA EXHAUST GAS SENSOR. *IEEE (Inst. Elect. Electron. Engrs.) Trans. Veh. Technol., 23(4): 125-128, Nov. 1974. 12 refs. (Presented at the Institute of Electrical and Electronics Engineers Vehicular Technology Conference, 24th, Cleveland, Ohio, Dec. 4-5, 1973.)*

A brief description of the zirconia exhaust gas sensor is given. The electrochemical principles of the sensor are reviewed. Starting from the Nernst equation, theoretical relations are derived which relate the galvanic potential of the sensor to the composition of the exhaust gas from an internal combustion engine. Theoretical curves of galvanic potential versus the inlet air-fuel ratio are shown and discussed. The utility of the zirconia exhaust gas sensor is defined in applications such as closed-loop electronic fuel injection engine control systems. (Author abstract)

48973 **APTIC NO. 70413**

Edwards, Harry W.

ENVIRONMENTAL CONTAMINATION BY AUTOMOTIVE LEAD. *Preprint, Commission of the European Communities, Environmental Protection Agency, Washington, D. C., and World Health Organization, New York, 7p., June 28, 1974. 9 refs. (Presented at the International Symposium-Environment and Health, Paris, France, June 1974.)*

Laboratory and field findings concerning the environmental flow of lead from automobiles are presented which indicate that previous methodologies used for lead measurements in the environment may not adequately reflect actual human lead exposures. The use of porous graphite spectrographic electrodes for air filters overcome the high lead blank problem of many conventional membrane filters. A second deficiency of many membrane filters is that in addition to organic lead very fine lead-containing particulates may escape collection; these small particulates may comprise a significant portion of the total atmospheric lead content. The implications are that many previously reported atmospheric lead values may be low and that many previously computed lead particle mass median diameters may be high. Field and wind-tunnel tests confirm that urban atmospheric lead levels are profoundly influenced by city geometry. Measurement of krypton-85 concentration profiles in a scale model placed in a wind tunnel indicate that street canyons formed by two and three story buildings can inhibit ventilation substantially. Lead concentrations of 10 microgram/cu m are observed for street canyons, while rooftop samplers indicate less than 1 microgram/cu m. These results demonstrate that rooftop samplers alone may not adequately reflect the lead exposures of persons living and working in city street canyons.

48974 **APTIC NO. 70421**

Ensor, David S. and Michael J. Pilat

THE CORRELATION OF PLUME OPACITY TO PARTICULATE MASS CONCENTRATION. *Preprint, American Inst. of Chemical Engineers, New York, 23p., 1974. 18 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 78th, Salt Lake City, Utah, Aug. 18-21, 1974, Paper 46c.)*

Plume opacity measured with an in-stack transmissometer is correlated with other particulate properties such as mass concentration. The data are interpreted theoretically based on the calculation of graphs showing the parameter K as a function of the particle size distribution as a basic part of the approach. The use of stack test equipment and opacity monitors was useful in gaining knowledge of the error limits in the application to design. The data from a Kraft recovery furnace and an aluminum refinery are reported as examples. (Author summary modified)

48975 **APTIC NO. 70303**

Fukuchi, T. and M. Oishi

EXAMINATION OF ODORANT SAMPLING METHODS. *(Akushu no sanpuringu- ho ni kansuru ichi kosatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):455, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 306.)*

Adsorption of odorant samples on sampling vessels was investigated by using acetone gas samples (2000-4000 ppm; 20 C; moisture content, 50%) and following concentration changes by gas chromatography. Sampling bags under investigation were made of Tedlar, Mylar, Saran, polyethylene, and vinyl chloride. Sampling flasks and bottles were also included in the study. Use of Mylar sampling bags and official gas-sampling bottles resulted in nearly 100% retention of acetone gas samples after 240 hours. On the other hand, nearly 100% adsorption of acetone on polyethylene bags occurred after 240 hours.

48976 **APTIC NO. 71012**

Fukuda, Masanori, Takeji Miyazaki, Shigeo Yamaoka, and Michio Oka

DETERMINATION OF SULFURIC ACID AEROSOL (II). *(Ryusan misuto no teiryoho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):243, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 103.)*

Interference by other sulfate salts with the colorimetric determination of sulfuric acid mist with chloranilic acid barium salt is studied. The sulfate salts tested are of ammonium, sodium, potassium, calcium, lead, copper, aluminum, and manganese. All of these sulfate salts interfered, and strong interference was observed with ammonium, sodium, and potassium sulfates; the least interference was found with calcium sulfate. The concentration range of sulfuric acid studied was up to 7 micrograms/ml. In some cases, interference effects were eliminated by using a propyl alcohol extraction technique.

48977 **APTIC NO. 71156**

Grams, G. W., A. J. Dascher, and C. M. Wyman

LASER POLAR NEPHELOMETER FOR AIRBORNE MEASUREMENTS OF AEROSOL OPTICAL PROPERTIES. *Preprint, National Center for Atmospheric Research, Boulder, Colo., 28p., Nov. 1974. 32 refs.*

A nephelometer is described for airborne measurement of polar scattering diagrams of atmospheric aerosols. The nephelometer light source is a modulated helium-neon laser; a digital synchronous photon counter is utilized to measure scattered-light intensity. The system is designed for airborne measurements on a pressureized aircraft using outside air ducted through a 5-centimeter airflow tube. The sample volume is that which is common to the itersection of the collimated source beam and the detector field of view within the airflow tube. The instrument was flown on the National Aeronautics and Space Administration Convair 990 airborne laboratory to obtain data on the complex index of refraction of atmospheric aerosols. Particle sizing devices were operated simultaneously to determine the aerosol size-number distribution. Calculated values of the angular variation of scattered-light intensity were obtained by applying Mie scattering theory to the observed size distribution function and by assuming different values of the complex index of refraction of the particles. The calculated values were then compared with data on the actual variation of the scattered-light intensity obtained with the polar nephelometer. The most probable value of the complex refractive index was assumed to be that which provided the best fit between the experimental light- scattering data and the polar-scattering diagrams calculated from the observed size distribution function. The device can be used to determine aerosol optical properties as data inputs for studies of the climatic effects of suspended particulate matter and for the interpretation of data obtained by remote sensing devices. (Author abstract modified)

48978 **APTIC NO. 70943**

Harrison, R. M., R. Perry, and D. H. Slater

AN ADSORPTION TECHNIQUE FOR THE DETERMINATION OF ORGANIC LEAD IN STREET AIR. *Atmos. Environ., 8(11):1187-1199, Nov. 1974. 16 refs.*

An adsorption technique for the determination of organic lead compounds in urban air is described. The adsorption tube (filled with 1.10 g of 10% Apiezon L on 60/80 mesh silanized acid-washed Universal support) is preceded by an 0.22 Millipore filter which separates the particulate lead from the air sample. A pump and gas meter are arranged in series after the adsorption sampling tube. A small heating coil, positioned before the adsorption tube, maintains the enclosed tube at a temperature just above ambient temperature to ensure that all condensation of water and other compounds from the air sample occurs within the sampling tube. After sampling the required volume of air (0.014-0.060 cu m), the sample tube is removed from the sampling equipment, sealed, and stored in liquid nitrogen until required for analysis which is performed by an atomic absorption spectrophotometer. The adsorption tube, together with a matched blank tube, is attached to a six-port switching valve linked to the combustion air stream of the spectrophotometer. Levels of organic lead as low as 0.003 micrograms/cu m may be measured by sampling the required volume of air over a period of 30-40 min. Typical results obtained with the method in the London area are tabulated for organic lead expressed as a percentage of total airborne lead.

48979 **APTIC NO. 71430**

Hartkamp, Heinrich and Gerhard Nitz

CONTRIBUTION TO THE PROBLEM OF THE SALTZMAN FACTOR AT THE MEASUREMENT OF NITROGEN DIOXIDE IMMISSIONS. *(Beitraege zum Problem des Saltzman Faktors bei der Messung von Stickstoffdiox- Immissionen). Text in German. Staub, Reinhaltung Luft, 34(12): 439-442, Dec. 1974. 24 refs.*

The stoichiometry of the reaction between Saltzman reagent and nitrogen dioxide at ambient air concentrations has been critically reviewed with emphasis on the yield of azo dye formation from nitrite ion and nitrogen dioxide. The investigation was carried out with well-defined standard gas mixtures prepared by means of a novel capillary dilution system. These experiments along with data gathered from a literature review establish the conversion factor as 1.00, as opposed to the value of 0.72 given by Saltzman.

48980 **APTIC NO. 70306**

Hasegawa, T., T. Ishiguro, Y. Shigeta, H. Nagai, S. Kagotani, H. Kitamura, and M. Seki

GAS CHROMATOGRAPHIC ANALYSIS OF ALIPHATIC AMINES IN AMIENT AIR. *(Taikichu amin-rui no sokutei hoho ni kansuru kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):458, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 309.)*

Low carbon aliphatic amines in the atmosphere were analyzed by trapping them in a sulfuric acid solution or on oxalic acid-impregnated glass fiber filter paper, treating with potassium hydroxide, then nitrogen gas, and passing the recovered amines through a gas chromatography column after low temperature concentration. Standard solutions of trimethylamine and dimethylamine were used to check consistency of results. Nearly 100% recovery of the amines was effected, with 10% reproducibility.

48981 **APTIC NO. 71140**

Hasegawa, Toshio, Ken Matsuo, Takashi Nakadoi, and Daisuke Kuroda

INVESTIGATION OF THE PRECISION OF NITROGEN OXIDES MEASUREMENT WITH JIS METHODS. *(Chisso sankabutsu hoteiho, JIS K 0104, no sokutei seido no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):404, Nov. 1974. (Presented at the National Air Pollution Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 255.)*

Three analytical methods for nitrogen oxides recommended by the Japan Industrial Standard (JIS K 0104), phenoldisulfonic acid, rapid PDS, and zinc reduction napthylethylene diamine, are compared for accuracy. A standard nitric oxide sample is prepared and distributed to the 28 laboratories which performed the sample analyses by each method. Statistics of their results are obtained. The average NOx values found by PDS, rapid PDS, and zinc reduction NEDA methods were 177.9, 179.2, and 178.9 ppm with standard deviations of 5.9, 8.0, and 5.7, respectively. The rapid PDS method gave the highest analytical value and the PDS method gave the lowest analytical value. The precision by the zinc reduction NEDA method was the best.

48982 **APTIC NO. 71042**

Hashimoto, Y. and M. Fujimura

ANALYSIS OF SIZE DISTRIBUTION DATA BY ANDERSEN SAMPLER. *(Andasen sanpura niyoru ryudo bunpu data no shori hoho no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):249, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 110.)*

In order to correlate size distribution data obtained by different air samplers, a more general method for processing the distribution data was developed. The proposed method expresses the data in differential form as cumulative wt% data. A simple histogram expression is very hard to interpret for two different sets of data obtained by different types of air samplers. Cumulative wt% expressions often deviate from linear plots. Iron and zinc dust samples were analyzed using the proposed differential expression. Iron dust showed one peak at particle size 4 micron, and zinc dust showed its maxima at 0.9 micron. When an air sample from Keio University (Yokohama City) area was measured, two peaks were observed, and one of them coincided with the iron peak at 4 micron.

48983 **APTIC NO. 71438**

Hatanaka, K., N. Miyamura, M. Takatsuka, N. Ito, and M. Murata

ANALYSIS OF HEAVY METALS IN DUSTFALL (I). *(Koka baijin no jukinzoku bunseki (I)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):223, Nov. 1974. 2 refs (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 81.)*

Heavy metal concentrations (cadmium, lead, zinc, copper, nickel, iron, manganese) in dust from dustfall on the roof, and dust in electrostatic precipitators were determined by ashing, extraction, and analysis by atomic absorption spectrometry. Powder used as standard was Spex Mirex Co., No. 1000. Recovery rates of 87-104% were obtained. Addition of sulfuric acid during the analysis to increase the recovery rate produced erratic results, depending on ashing temperature.

48984 **APTIC NO. 71442**

Hayakawa, M., T. Sakai, T. Aoyama, and E. Ito

MEASUREMENT OF ATMOSPHERIC MERCURY CONCENTRATION. *(Taikichu no suigin nodo no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):227, Nov. 1974. (Presented at the National*

Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6o8, 1974, Paper 86.)

Five sampling methods for determining atmospheric mercury concentrations were investigated. The methods are as follows: wet method; filter method (high-volume glass-filter, millipore filter, chromate-sulfuric acid treated glass filter); and a U-tube method. The wet method is best suited for mercury concentrations above 0.1 micrograms/cu m. Both untreated filters resulted in low recovery rates. Recovery rate was good for the U-tube method, but preparation and analytical treatment were complicated. The filter, treated with CrO_3-H_2SO_4, seemed to be best from standpoint of relatively high recovery and procedural ease.

48985 **APTIC NO. 70853**

Heiken, Grant

AN ATLAS OF VOLCANIC ASH. *Smithson. Contrib. Earth Sci., no. 12:1-106, 1974. 38 refs.*

NTIS: N74-25882, GPO

Volcanic ash samples collected from a variety of recent eruptions were characterized using petrography, chemical analyses, and scanning electron microscopy. Ash morphology was related to magma composition and eruption type. Ashes were either magmatic or hydrovolcanic (phreatomagmatic). The morphology of ash particles from magmatic eruptions of high-viscosity magma was governed primarily by vesicle density and shape. Ash particles from eruptions of low-viscosity magmas were mostly droplets. Droplet shape was in part controlled by surface tension, acceleration of the droplets leaving the vent, and air friction. Shapes ranged from perfect spheres to a variety of twisted, elongate droplets, with smooth, fluidal surfaces. The morphology of ash particles from hydrovolcanic eruptions was controlled by stresses within the chilled magma which result in fragmentation of the glass to form small blocky or pyramidal ash particles. (Author abstract modified)

48986 **APTIC NO. 70676**

Hertzendorf, M. S.

CONVERSION OF AIR POLLUTION UNITS. *Pollut. Eng., 6(12):34-35, Dec. 1974.*

In air pollution engineering, concentrations of atmospheric gaseous pollutants are usually presented either as a volumetric ratio (ppm of air), or on a gravimetric basis (weight of pollutant per unit volume as mg/cu m or micrograms/cu m). Since it is desirable to convert one to another easily, a simple method for conversion and a conversion chart nomograph were developed.

48987 **APTIC NO. 71411**

Heshmat-Chaaban, G. and C. Triche

DETERMINATION OF HALOGENS BY MEANS OF EMISSION SPECTROGRAPHY IN AIR WITH A PULSED SOURCE. INFLUENCE OF POLARITY. *(Dosage, par spectrographie d emission dans l air, des halogenes a l aide d une source a impulsion. Influence de la polarite). Text in French. Fresenius Z. Anal. Chem., 272(2):114-117, 1974. 26 refs.*

A high power pulsed power is used to determine halogens under the usual conditions of emission spectrography. A limit of sensitivity of 5 to 10 ppm has been obtained except for fluorine where it is on the order of 400 ppm. The conditions for better sensitivity are discussed including the influence of the kind of matrix and polarity.

48988 **APTIC NO. 71111**

Hirasawa, Shinzo

MEASUREMENTS IN THE CONTROL OF NOX. *(NOx no yokusei gijutsu ni okeru keisoku sokutei ni tsuite). Text in Japanese. Sangyo Kogai Boshi Gijutsu (Ind. Pollut. Control Tech.), 1974:91-100, June 1974. 12 refs.*

A review is given of the control of nitrogen oxides in exhaust, the methods of measurement of NOx, and the problems related to its determination. Major sources of exhaust of NOx are boilers used in power plants, melting furnaces for glass, heating furnaces, high temperature blast furnaces, coke furnaces, Portland cement kilns, cupolas, converters, and sintering furnaces. Combustion at low oxygen pressure, recirculation of exhaust gases, and 2-stage combustion are being examined for the suppression of NOx concentration in exhaust gas. These methods reduce the NOx formation by only 30-50%. For the determination of NOx, 5 chemical methods and 9 continuous methods are adopted by JIS. These are the phenoldisulfonic acid method, nitrate ion electrode method, zinc reduction-naphthylethylenediamine method, naphthylethylenediamine method, Saltzman method, chemiluminescence method, infrared absorption, ultraviolet absorption, potentiostatic method, galvanostatic coulometric method, oxidation method, reduction method, and the output summation method. Tables are given for the concentration range of NOx to be determined, chemical species to be determined, principles of measurement, methods of collection of sample gases, simplicity, skills required for the practice, effects of impurities, and apparatuses used.

48989 **APTIC NO. 71006**

Honma, Katsunori, Moriyoshi Hashimoto, and Kimiyuki Kitabayashi

CONSTRUCTION OF ANDERSEN MIDDLE VOLUME SAMPLERS. *(100 l/min kyuinyo Andersen Sampler no shisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):248, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 109.)*

A modified Andersen low volume sampler was constructed with a modification made to suck more sample per unit time; 100 l/min was achieved by the modification, which would allow a rapid analysis of particle size distribution. The reliability of the modified sampler was investigated using colloidal silica sample. The sample silica is prepared by spraying colloidal silica into an 8-cubic meter chamber. From this chamber, sample is sucked by both the modified Andersen sampler and a conventional low volume Andersen sampler (28.3 l/min), and both results on the particle size distribution are compared. The two samplers both have seven-stage traps plus a backup filter, and each stage is weighed after the sample suction is completed. The cumulative wt% of silica in each stage is plotted against particle size diameter. The plots made by the two samplers were almost identical, indicating that the modified Andersen sampler is as dependable as the conventional low volume Andersen sampler.

48990 **APTIC NO. 71007**

Honma, Katsunori, Yasuaki Furukawa, Hiromi Uno, Takaaki Taninaka, Eiji Yamashita, and Masanao Funashima

CALIBRATION OF DIGITAL DUST INDICATOR BY FREON GAS. *(Fureon gasu niyoru dejitaru funjinkei no kando kosei hoho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):247, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 107.)*

Freon-12 gas was tested by six different digital dust indicators to see if Freon-12 gas could be used to calibrate a digital dust indicator. The results of the six dust indicators were compared. Whenever each indicator was thought to be performing correctly in routine analysis, Freon-12 was used as a sample for the dust indicator and the response factor for Freon-12 was obtained. Twenty eight measurements were made for Freon-12 and the average response factor was 38.08 cph. The best standard deviation obtained was 0.42 with an average response factor of 38.3 cph. TThe worst standard deviation was 4.09 with an average response factor of 37.6 cph. Therefore, Freon-12 can be used to calibrate digital dust indicators.

48991 **APTIC NO. 71095**

Honma, Katsunori

MEASUREMENT OF A CONVERSION FACTOR TO DERIVE AEROSOL WEIGHT CONCENTRATION FROM RELATIVE CONCENTRATIONS FOR THE DIGITAL DUST INDICATOR USING A PARTICLE MASS MONITOR. *(Particle Mass Monitor: T.S.I. ni yoru dejitaru funjin-kei no juryo nodo kansan keisu no sanshutsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):259, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 120.)*

Conversion factors for particulate concentration data obtained by digital dust indicator, low volume air sampler with a silver membrane, and particle mass monitor are calculated. The air sample is analyzed by the three instruments for 1 hr, and three different particulate data groups were obtained. The conversion factor for the data obtained by digital dust indicator and particle mass monitor was 0.91, and the conversion factor between particle mass monitor and low volume air sampler was 0.99. The particles collected ranged between 20 to 220 micrograms/cu m.

48992 **APTIC NO. 71100**

Honma, Katsunori and Shigeharu Koshi

INVESTIGATION ON CONTROL METHOD FOR THE DIGITAL DUST INDICATOR A 632. *(Fuyu ryushijo bushitsu kanshi kiroku sochi no kanri hoho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):257, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 118.)*

Seven digital dust indicators type A 632 are selected from seven different laboratories, and compared for operational performance in order to find the necessary maintenance procedures for the dust indicator. The study is conducted once every 4 mo for 1 yr. Each dust indicator is calibrated to a factor of 0.3 micron stearic acid aerosol. Background scattering and sensitivity variation are also examined for each dust indicator. The sensitivity variation found in the seven indicators was +13% to -8%. The background counting was 3.0 to 4.5 cph for six indicators and 6 to 12 cph for the seventh indicator. The sensitivity variation resulted from the age of the photomultiplier tube. The accumulation of dust and spider webs were both noted in every 4-month inspection, which caused a higher background count. The sensitivity factor did not vary between inspections. Four out of seven dust indicators were manufactured prior to 1969. The inspection of the dust indicator would not cause a significant error in its routine operation.

48993 **APTIC NO. 70580**

Hoshika, Yasuyuki, Ichiro Kojima, Kazumi Koike, and Kenji Yoshimoto

GAS CHROMATOGRAPHIC ANALYSIS OF THE TRACE COMPONENTS IN DIMETHYL SULFIDE (DMS), AND DIMETHYL DISULFIDE (DMDS). *(Jimechiru sarufide (DMS) oyobi jimechiru jisarufide (DMDS) no biryo konnyu fujunbutsu no gasu kuromatografu bunseki). Text in Japanese. Kogai (Hokua Shobo) (Pollution Control), 9(5):47-50, Sept. 1974. 3 refs.*

Trace impurities in the commercial analytical grade of dimethyl sulfide (DMS) and dimethyl disulfide (DMDS) were analyzed by gas chromatography using a flame detector. The columns used are 25% Tris (2-cyanoethoxy) propan on shimalite 60/80 mesh, 25% Tri cresyl phosphate on shimalite 60/80 mesh, and 10% Polyphenyl ether on shimalite 60/80 mesh. The standard sample gases were prepared by putting 1 micromilliliter of liquid DMS or DMDS into a 100-cubic centimeter pyrex flask evaporating it. Using a gas-tight syringe, 1 cc of the prepared gaseous sample was injected into the gas chromatograph. The impurities in DMS were 710 ppm of DMDS, 355 ppm of carbon disulfide, and 95 ppm of n-butyl ethyl sulfide and diallyl sulfide. The impurities in DMDS were 190 ppm of methyl mercaptan, ethyl mercaptan, isopropyl mercaptan, and t-butyl mercaptan, and 95 ppm of DMS, diethyl sulfide, and diisodiallyl sulfide. These impurity levels are low enough to allow the commercial analytical reagent to be used as a standard reagent for odor analysis.

48994 **APTIC NO. 70813**

Hrubesh, L. W., M. S. Felice, and V. J. Barton

A COMPUTERIZED MICROWAVE SPECTROMETER FOR ROTATIONAL SPECTRAL STUDIES AT PRESSURES GREATER THAN 1 TORR. *Chem. Instrum., 5(3): 179-186, 1973-1974. 5 refs.*

A computerized microwave spectrometer system is described that can compute the net microwave absorption spectra of gases at pressures greater than 1 torr. The procedure for acquiring the microwave absorption spectrum of a gas with the system starts by evacuating the sample cell. A software program written in the FOCAL language then directs a controlled frequency scan over the 17-27 GHz range in 4096 discrete steps. This gives a resolution of about 2.4 MHz per step which is about one-tenth of the full linewidth for most gas absorptions at 1 torr. A number of data points are then taken at each frequency step, and the mean value of each data point group is computed and stored in an array on the disk. The cell is then filled with gas to the desired pressure, and the software directs another controlled frequency scan of 4096 frequencies. Data processing then results in a net absorption value which is stored on the disk for punch out on paper and plotting on an X-Y axis. Absorption spectra for pure ammonia, sulfur dioxide, and nitrogen dioxide obtained at a pressure of 10 torr are presented and demonstrate the feasibility of obtaining qualitative and semiquantitative information. The approach may have direct applicability for trace gas investigations in rarefied atmospheres (e.g., the earth s stratosphere); and, since high concentrations of NH3 and SO2 are identifiable even in a background of air at a pressure of 1 atm, the technique may also be applicable to stack monitoring with horn antennas replacing the waveguide cell.

48995 **APTIC NO. 71070**

Imagami, K.

MEASURING TECHNIQUE FOR SUSPENDED PARTICULATES. *(Baijin no keisoku gijutsu). Text in Japanese. Sangyo Kogai Boshi Gijutsu (Ind. Pollut. Control Tech.), 1974:101-107, June 1973. 9 refs.*

Specifications were given in JIS Z 8808 for the measurement of the amount of exhausted suspended particulates. However, this JIS has 2 faults: the measurements are affected by the characteristics of the filter material used, and it is necessary to make the sample gas pass through the apparatus at a constant rate. The passage of the sample gas at a definite rate is accomplished by either an equilibrium sample collector or by an ordinary sample collecting tube. However, the former is accompanied by the loss of static pressure, which is very difficult to compensate for. The latter is also very difficult to handle and to calibrate. In order to overcome these difficulties, 2 apparatuses, the equilibrium type sample collector Type I and the constant speed gas collector of the dynamic pressure comparison type, were proposed. The former consists of a simple tube about 245 mm long. The tube is equipped with filter paper, a nozzle, and measuring pipes. The latter also consists of a tube, 180 mm long and 20 mm in diameter. It is equipped with a Pitot tube. Both of these are very simple in construction and gave satisfactory results.

48996 **APTIC NO. 70365**

Imamura, Kiyoshi, and Toru Fujii

STUDIES ON HYDROCARONS IN AIR(3) QUANTITATIVE ANALYSIS OF TOLUENE Y GC-MS. *(Taikichuno tankasuiso ni kansuru kenkyu (3) GC-MS ni yoru toruen no teiryo). Text in Japanese. Preprint, Japan*

Chemical Society, p. 535, 1974. (Presented at the Japan Chemical Society, Fall Meeting, 31st, Sendai, Japan, 1974.)

A gas chromatographic-mass spectrometric (GC-MS) single ion monitor method was used for quantitative anlaysis of toluene in air. The instrument was a Shimazu LK-9000 GC-MS, and the column for the GC was packed with enton 34 + DDP (5% + 5%) with chromosob W (60/80 mesh) as a solid support. Two ions with m/e of 92 and 91 were found with different intensities, the former being the parent ion, while the latter was the tropylium cation. The intensities of the two ions increased with increasing ionization potential, reaching to a maximum at 60-70 eV. Linear calibration curve of the tropylium cation intensity was obtained between 0.2 ng and 2.3 ng of toluene. The standard deviation was approximately 4.5% at 2.3 ng toluene. The minimum quantity for the determination of air sample containing a ppb order of toluene was about 2 ml.

48997 **APTIC NO. 71441**

Inaba, F., T. Kobayashi, and T. Matsumoto

REMOTE MEASUREMENT OF AIR POLLUTION MOLECULES BY THE INFRARED HETERODYNE-SCHEME LASER RADAR. *(Sekigai iki heterodain hoshiki reza reda ni yoru taiki osen bunshi no enkaku keisokuho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):219, Nov. 1974. 2 refs. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 76.)*

Laser radar can be utilized to determine concentrations of air pollutant molecules at distances of 0.1-10 km. Differential absorption in the infrared region results in highly sensitive and highly accurate determination of pollutant molecule concentration distributions at levels found in the environment.

48998 **APTIC NO. 70307**

Ishiguro, T., T. Hasegawa, Y. Shigeta, M. Sakata, H. Nagai, H. Kitamura, and M. Seki

GAS CHROMATOGRAPHIC ANALYSIS OF DIMETHYLDISULFIDE IN AMIENT AIR. *(Taikichu niryuka mechiru no sokutei hoho ni kansuru kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):459, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 310.)*

Analysis of dimethyldisulfide (10 ppb) was effected by two methods outlined in Report No. 9 of the Environmental Agency, Japan. In the first method, a sampling bottle, treated with phosphoric acid, filled with pure nitrogen gas, then evacuated, was used to collect the gas sample. The gas sample is collected in a concentration vessel (and cooled in liquid oxygen) by alternate evacuation and flushing of the sample bottle. Gas chromatography is conducted on the gas sample after removal of the liquid oxygen coolant. In the second method, a Tedlar bag was used for gas sample collection. The bag was then connected to a gas concentration vessel, cooled in liquid oxygen, and a gas sample was transferred to it. Procedures described for the first method were then followed. After four trials with each method, fluctuation was within 10%.

48999 **APTIC NO. 70648**

Ishikawa, K., N. Kano, O. Hamamoto, and K. Saeki

STUDIES ON THE DETERMINATION OF SULPHUR DIOXIDE (1) - THE REPEATAILITY WITHIN THE SAME LAORATORY AND THE REPRODUCIILITY ETWEEN THE DIFFERENT LAORATORIES. *(SO2 ni kansuru kenkyu (1) - bunseki jo-kan narabi ni bunsekijonai kurikaeshi gosa ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):431, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 282.)*

Five analytical methods for sulfur dioxide including alusenazo III, neutralization, barium chloranilate, conductivity, and infrared methods were examined for thei dependability. Gas containing 100 ppm or 1000 ppm sulfur dioxide and solid mixtures of sodium sulfate and sodium chloride (1:1) were used as samples. Chemical methods resulted in greater differences among 17 experimental stations who joined the program. The error of sampling was greater as the concentration became lower; the neutralization method could be used for the measurement of 100 ppm SO2 when N/50 NaOH was used to remove carbon dioxide. The results of continuous methods were approximately 10% lower than those of chemical methods.

49000 **APTIC NO. 70299**

Iwasaki, Y., H. Fukushima, H. Onozuka, T. Ishiguro, and T. Ohira

STUDY ON SELECTION OF PERSONNEL AND SIZE OF OLFACTORY PANELS. *(Shukaku paneru no sentei oyobi ninzu no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):450, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 300.)*

A panel was selected to smell three standard odors (iso-valeric acid, skatole, and cyclotene) and its findings were analyzed with respect to sex, age, physical condition, tobacco usage, confidence, and expertise in odor detection. A normal distribution for human odor detection ability was assumed. A range of plus or minus 10% was the goal for reliability.

49001 **APTIC NO. 71104**

Iwashima, K., M. Fujita, N. Yamagata, H. Takahata, and Y. Kajiwara

NEUTRON ACTIVATION ANALYSIS OF ARSENIC PARTICULATE. *(Taiki fuyujin chu no hoshaka bunsekiho). Text in Japanese. Preprint, p. 8, 1974. (Presented at the Environmental Toxicology Symposium, 1st, Osaka, Japan, Nov. 21-22, 1974, Paper 8.)*

The sensitivity and accuracy of measurement methods for atmospheric arsenic in suspended particulates were greatly improved by neutron activation analysis. Interfering nuclides were separated by radiochemical procedure, and the activated As was measured by gamma ray spectrometry. The decrement curve of 559.1 KeV peak was in agreement with that of standard sample, and therefore the 559.1 KeV peak was used for quantitative determination. The lower concentration limit for determination was 0.5 ng. Since no peak corresponding to 74 As was found in the gamma ray spectrum of the As fraction, the use of 74 As for chemical yield measurement was justified. Arsenic concentrations measured in four cities in 1974 were 1.1-108.1 in Okinawa, 0.36-11.9 in Miyazaki, 0.73-2.0 in Kumamoto and 5.5-9.7 (ng As/cu m) in Tokyo.

49002 **APTIC NO. 71333**

Izotova, A. I., P. F. Shevchenko, E. Y. Shaposhnikova, and E. N. Stepanov

NEW SPECIFIC PHOTOCOLORIMETRIC METHOD FOR THE DETERMINATION OF CARBON MONOXIDE IN THE AIR. *(No''yy spetsifichnyy fotokolorimetricheskiy metod opredeleniya okisi ugleroda v vozdukhe). Text in Russian. Gigiena i Sanit., no. 9:57-60, 1974. 1 ref.*

A new sensitive, specific method for the photocolorimetric determination of carbon monoxide in the air is described. The air sample to be analyzed is admitted into a flask of 100-200 cu m, after which a solution of bis-(o-phenanthroline)-palladium chloride and hydrazine hydrate are added. The flask is shaken, and then thermostatized at 50 + or - 20 C for 10 min, after which ammonia is added. The optical density is measured at 545 nanom against a blank sample. The sensitivity of the method amounts to 0.0005% by volume, and one analysis takes 15 min.

49003 **APTIC NO. 71005**

Kadowaki, Rei, Ichiro Kojima, and Kazumi Koike

SIZE DISTRIBUTION OF ATMOSPHERIC PARTICULATE MATTER IN URBAN AIR. *(Toshi taikichu ni okeruryushijo bushitsu no ryudo bunpu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):251, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 112.)*

An evaluation technique for particle size distribution data is discussed. An Andersen sampler (Model 21-000, 9 state traps) is used to analyze atmospheric particle size distribution. The obtained cumulative wt% plots versus logarithmic particle sizes was not linear, indicating that atmospheric particulate matter does not show a logarithmic normal distribution pattern. Two peaks were found from the curve obtained when the cumulative wt% curve was differentiated by the logarithm of particle size. The two peaks occurred at around 0.5 micron and 4 micron. The observed particle size distribution curve would thus be the result of the overlapping distribution of two different particle groups. When the cumulative wt% curve was approximated to be linear by assuming the logarithmic normal distribution of particles, a single peak was found at around 2 micron in the differential curve, however, assumption would not be appropriate.

49004 **APTIC NO. 70516**

Kaminari, Teruo and Hitoshi Nagai

THE POSSIILITY FOR SIMPLIFYING DUST MEASUREMENT Y USING MEASUREMENT EQUIPMENT Y THE PILLAR CO. *(Piraru-sha no sokuteiki o mochiita kanika no kanosei: baijinryo kani sokuteiho). Text in Japanese. Kogyo Kanetsu (Ind. Heating), 11(5):313-317, 323, Sept. 1974. 4 refs.*

Characteristics of an OPASTOP GP analyzer for measuring the fly ash concentration are described. With OPASTOP GP, light scattering by airborne fly ash is measured with glass fiberscopes to determine concentrations. In the usual procedures, exhaust gas is collected with dust tubes (JIS Z8808 analyzer) or filter paper (achrach analyzer) to determine concentrations. In test runs, different heavy oils were burned to heat a steam boiler, and the fly ash concentration was measured with the three measuring devices at a mid-point spot in the cylindrical flue. It was determined that OPASTOP GP analyzer can be used to measure low to high concentrations of fly ash, even concentrations so low as to be almost invisible to the naked eye. The OPASTOP GP analyzer can be connected to alarm systems for monitoring combustion conditions. It is also possible to use the analyzer in conjunction with other automatic control and recording equipment...

49005 **APTIC NO. 70697**

Kano, N. and S. Yoshimoto

STUDIES ON THE DETERMINATION OF SULPHUR DIOXIDE (2) - THE HANDLING ERROR OF EXPERIMENTAL WET GAS METERS. *(SO2 teiryo ni kansuru kenkyu (2) - shisshiki gasu meita no toira tsukai gosa ni tsuite -). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):432, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 283.)*

Twelve gas meters were checked for performance using a standrrd gas meter. The machine condition and operating condition greatly affected the performance of the gas meter. The inclination of water level had a noticable effect on the indicator. Analysis of answers of questions given to 19 gas meter owners revealed that about 1/3 of the machines were not correctly handled and about 2/3 of the machines were not rectified. More than half of the operators made inproper readings.

49006 **APTIC NO. 70960**

Kato, Tatsuo and Shinji Nakayama

TOTAL ANALYSIS OF AIR POLLUTANTS. NO. 26. *(Taiki osen no zenbunseki Dai-26-ho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):216, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 73.)*

The validity of using a gas chromatograph-mass spectrometer (GC-MS) along with gas chromatography for environmental analysis was examined by measuring multi-component environmental pollutants in Ichihara and Kawasaki industrial areas. Air samples collected at 50 locations were analyzed and examples of mass spectrum, thin layer, and flame ionization detector chromatograms are given. The pollutants identified were methanol, ethanol, 2-butyl alcohol, acetone, methyl ethyl ketone, methyl acetate, ethyl acetate, n-butyl acetate, acetaldehyde, propionaldehyde, ethyl acrylate, methyl methacrylate, methyl cyclopentane, cyclohexane, cyclopentadiene, 1,3-butadiene, 2-methyl-1-pentene, 2,3-dimethyl butane, and 1,3-butadiene. By comparing the gas chromatographic pattern of samples collected in residential and industrial areas, the major pollutant sources were identified.

49007 **APTIC NO. 71110**

Kawaguchi, Hiromi

THE TRENDS IN THE STANDARDIZATION OF AUTOMATIC MEASURING INSTRUMENTS OF ATMOSPHERIC POLLUTION. *(Taiki osen kogai jido keisoku-ki no hyojunka no hoko). Text in Japanese. Sangyo Kogai Boshi Gijutsu (Ind. Pollut. Control Tech.), 1974:22-25, June 1974.*

The history of atmospheric pollution measurements is reviewed with a discussion of the standardization of measuring instruments. Although atmospheric pollution measurements were started only several years ago, the necessity of measurement is increasing rapidly because of the seriousness of industrial pollution. The first step for standardization is the establishment of specifications by JIS. The Japanese Ministry of International Trade and Industry has asked the Industrial Pollution Prevention Society to study and to collect data required for standardization. The instruments themselves are to be examined by the Japanese Society of Electric Measuring Instruments. The specifications by JIS will be established by the end of March 1976. The specifications to be published first will be JIS 7951, automatic measuring instrument of carbon monoxide in the atmosphere, JIS 7952, automatic measuring instrument of carbon dioxide in the atmosphere, JIS 7953, automatic measuring instrument of nitrogen oxide in the atmosphere, and JIS 7954, automatic measuring instrument of suspended particulate in the atmosphere.

49008 **APTIC NO. 70635**

Kawai, Yoichi

THE RECENT TREND IN POLLUTION ANALYZER. *(Kogai bunsekikei no saikin no doko ni tsuite). Text in Japanese. Ammonia to Kogyo (J. Ammonium Ind.), 27(1):27-39, 1974. 4 refs.*

Various analyzers for atmospheric and water pollutants are described in reference to the pollution control standards. The check points for selecting measurement methods, analyzers, installation locations, and sampling points are listed. The measurement methods for each pollutant are summarized in tabular form. An examples, the measurement methods for sulfur oxides, nitrogen oxides, suspended particulates, and sulfur content in fuel are described with procedures and flow sheets of measurement systems. For the measurement of pollutants in water, the measurement items and procedures are reviewed with flow sheets of systems. The systems approach to environmental pollution control plans is discussed with examples of the total control system, air pollution monitoring system, and water pollution control system.

49009 **APTIC NO. 71041**

Kimura, Norio, Yoshinari Hasegawa, Tadashi Okajima, and Hajime Mizuta

DEVELOPMENT OF PARTICLE SIZE ANALYZER FOR DUST BY MICRO-CYCLONE METHOD. *(Kogata saikuron hoshiki niyoru fuyu funjin ryudo sokuteiki no kaihatsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):250, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 111.)*

A cyclone type dust analyzer was constructed and tested for its reliability. The developed analyzer has the capability of trapping dust sizes 0.3 micron to 10 micron. Several micro-cyclones were placed parallel to the outlet of the centrifugal separator. Magnesium carbonate, zinc oxide, ferric oxide, and fly ash were used as industrial dust samples to test the dust analyzer. The dust was prepared by the jet dispersion technique. The particle size distributions are plotted as cumulative wt% versus particle size. The results obtained for zinc oxide and magnesium carbonate were in good agreement with those particle size distributions reported by others using different dust analyzers indicating the reliability of the cyclone type dust analyzer. The adjustment of dust streams to each cyclone is important in this analyzer, and it is adjusted with respect to the mono-function of the stream distribution coefficients.

49010 **APTIC NO. 70942**

Kinsman, S.

INSTRUMENTATION FOR FILTRATION TESTS. *Chem. Eng. Progr., 70(12):48-51, Dec. 1974. 13 refs.*

Instrumentation for the evaluation of dust filter performance is reviewed. Photometers, turbidimeters, and nephelometers can be used on-stream and provide data with very little time delay. They are calibrated in Jackson Turbidimeter Units or in Formazin Turbidimeter Units. Automatic one-by-one particle counters involving automatic microscope slide scanning and image analysis can furnish high speed particle counting and sizing from microscope slides made from test dusts collected upstream and downstream of a filter device under test. A compromise between manual microscopes and automatic scanning image analyzers is the splitting double image device which offers greater dimensional and statistical accuracy than the manual microscope and somewhat less than automatic scanning, though it is less expensive than the latter technique. Automatic one-by-one particle counting and sizing instruments which sample directly from a liquid suspension are commercially available based on the principles of light scatter, light interference, and the Coulter principle (electric current flow interruption). The latter type require that the sample be suspended in an electrolyte. The use of such automated particle counters enable filter efficiency profiles to be obtained for particle size levels, pressure levels, flow levels, loading levels, and time levels.

49011 **APTIC NO. 71503**

Kitamura, Shinzo, Yoshishige Murakami, Yutaka Suzuki, Masataro Nishimura, Yasukazu Izawa, and Chiyoe Yamanaka

LASER RADAR SYSTEM FOR OBSERVING ATMOSPHERIC CONDITIONS. *Osaka Daigaku Kogaku Hokoku (Technol. Rep. Osaka Univ.), 24(1191-1229): 545-555, Oct. 1974. 8 refs.*

A laser radar (lidar) system with an on-line digital computer data processing system is described along with some preliminary results from studies of atmospheric aerosols. The received signal from a Q-switched ruby laser is sampled with a telescope, converted to electrical signals by a photomultiplier, and then transferred to a digital computer for data processing. The digitized data can either be punched out on paper tape or be transferred to a computer via on-line cables and an interface circuit including buffer memories. The main program is written in FORTRAN, and the computer time for one laser shot is several seconds. This time can be considerably reduced, however, by using ASSEMBLER language. Studies of smog layers during the winter with the system revealed strong scattering layers up to about 1000 m during the daytime. Over the course of the day the layers dispersed, with only a weak scattering layer remaining at a 200-meter altitude around midnight. Range-height across sections of the aerosol structure revealed boundaries that were suggestive of an inversion layer.

49012 **APTIC NO. 71447**

Kobayashi, N., M. Ogawa, and H. Kodama

SEVERAL EXPERIMENTAL STUDIES OF MEASUREMENT METHODS FOR NOX IN FLUE GAS WITH AN NO3 ION ELECTRODE. *(Haigasu chu no chisso sankabutsu no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):405, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 256.)*

Time required to analyze nitrogen oxides by the nitrate ion electrode method is shortened by achieving faster NOx absorption by the solution during sampling. Faster oxidation was achieved by increasing the amount of absorbing solution in the flask or shaking it. Shaking the flask shortened the required oxidation time by 50% and the time was further shortened by 25% when four times the original amount of absorbing solution was employed. An increase in the NOx detection limit was also obtained by using a larger amount of absorbing solution. The detection limits in experiments utilizing 10 ml and 40 ml of absorbing solution were 10 ppm and 40 ppm, respectively.

49013 **APTIC NO. 70962**

Kodama, Takenori and Yoshiharu Takai

DETERMINATION OF PHTHALIC ACID ESTER IN THE ATMOSPHERE. *(Taikichu no futarusan esuteru no bunseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):215, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 72.)*

Atmospheric phthalic acid ester (PAE) emitted from plastics production was determined. Air samples containing PAE were collected in ethylene glycol by the gas-liquid absorption method, extracted with hexane, washed several times with water, dehydrated with anhydrous sodium sulfate, concentrated by rotary evaporator, and analyzed by gas chromatograph (GC). When quantitative determination is difficult due to the complexity of GC peaks, the above-mentioned concentrated sample solution is separated by column chromatography using n-hexane (polychlorinated biphenyls), n-C6H14 containing 10% ether (agricultural chemicals), and n-C6H14 containing 30% ether (PAE) as solvents. The eluate containing PAE was concentrated and determined by GC. The PAE in rain water and industrial waste water was extracted by a circulating steam distillation method, and determined by similar procedures. The flow sheet of procedures and GC measurement conditions are also given.

49014 **APTIC NO. 71363**

Koyama, I., T. Ishiguro, Y. Iwasaki, and S. Fukushima

REPRESENTATIVENESS OF AIR POLLUTION; ODOR. *(Taiki osen no daihyosei ni tsuite, akushu o rei ni shite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):545, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 394.)*

Various concentrations of iso-valeric acid and gamma-undecalactone solutions were prepared using an odorless solvent, and applied on scent papers. The sensitivity of human olfaction was tested with these papers.

49015 **APTIC NO. 71457**

Kuwata, K., Y. Yamasaki, Y. Eguchi, and Y. Matsuo

GAS CHROMATOGRAPHIC ANALYSIS OF AROMATIC HYDROCARBONS, ESTERS, KETONES, AND ALCOHOLS. *(Gas chromatography ni yoru kankyochu no hokozoku tankasuiso, ketone, ester, alcohol rui no bunseki (2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):197, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Air containing ppb levels of gases was collected by sampling bag and was analyzed by gas chromatography with flame ionization detector after concentration and purification of 116 ml of the sample air in a stainless steel column packed with Tenax GC (60/80 mesh). The concentrated gases were then heated at 140 degrees and analyzed by a 2 mm inside diameter by 3 m column packed with 20% PEO 20 M on Celite 545 (80/100 mesh). Nine aromatic hydrocarbons including 20.5 ppb benzene, 15.0 ppb toluene, 15.3 ppb ethylbenzene, 15 ppb m- and p-xylene, 16.0 ppb o-xylene, 14.2 ppb 3-ethyltoluene, 14.5 ppb mesitylene, 29.3 ppb 2-ethyltoluene, 28.1 ppb pseudocumene, and ppb levels of ethyl acetate, ketones, and alcohols were detected.

49016 **APTIC NO. 70479**

Lao, R. C., R. S. Thomas, T. Teichman, and L. Dubois

EFFICIENCY OF COLLECTION OF ARSENIC TRIOXIDE IN HIGH VOLUME SAMPLING. *Sci. Total Environ., vol. 2:373-379, 1974. 10 refs.*

Arsenic trioxide concentrations in the air have been measured without adequate consideration of the physical properties of arsenic compounds in the ambient condition. Therefore, a series of experiments was conducted to assess the influence of temperature, air flow rate, and vapor pressure upon the collection efficiency of the filtration sampling technique used for arsenic trioxide and other particulate contaminants found in polluted air. When the sampling medium and ambient air being sampled were at the sample temperature, filter collection efficiencies of less than 10% resulted and quantitative analyses were meaningless. Therefore, it must be accepted that all published data for arsenic concentrations in air which assumed a high collection efficiency for filter sampling were inaccurate. The physical and chemical properties of the compounds being sampled should always be considered before inauguration of any air pollution monitoring program. (Author summary modified)

49017 **APTIC NO. 70812**

Lapple, C. E. and E. E. Uthe

REMOTE SENSING OF PARTICULATE STACK EMISSIONS. *Preprint, American Inst. of Chemical Engineers, New York, 56p., 1974. 12 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 78th, Salt Lake City, Utah, Aug. 20, 1974.)*

Experimental studies were performed to establish the transmission and backscatter of a pulsed-laser (lidar) beam aimed at a particulate stack emission as a function of particulate concentration and particle size. Two laser wavelengths (0.7 and 1.06 micron) were used. The stack was simulated by a wind tunnel provided with open ends and protective aerosol curtains; and the aerosol was generated using fly ash which was classified into various size fractions (0-2.5, 2.5-5, 5-10, and 0-10 micron in diameter). At both wavelengths, the lidar measurements of transmission (or opacity) correlated well with conventional white- light transmissometer measurements. The lidar backscatter was essentially a measure of plume opacity at both wavelengths, being independent of particulate size. The 1.06 micron wavelength gave a poorer correlation with plume opacity than the 0.7 micron wavelength. For a given mass concentration, the backscatter was dependent on the particulate size at both wavelengths, varying as the minus 1.0 power of the Sauter diameter for the 0.7 micron wavelength and as the minus 0.5 power for the 1.06 micron wavelength.. Thus, the establishment of mass concentrations from backscatter measurements is less subject to particle size variations at the 1.06 micron wavelength than at the 0.7 micron wavelength. Values of both backscatter and extinction computed from Mie theory agreed with the observed data within thhe precision of measurement. (Author abstract modified)

49018 **APTIC NO. 71175**

Levin, Ira W.

LASER RAMAN SPECTROSCOPY. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.), New York, Academic Press, 1974, p. 45-120. 130 refs.*

Laser Raman spectroscopy is reviewed in terms of the principles of vibrational spectroscopy, Raman instrumentation and sampling techniques, and applications involving the characterization of chemical species, including its potential use for odor identification. Many of the Raman techniques applied to atmospheric pollution detection appear adaptable to more complicated volatiles responsible for odors. The molecular resonance Raman effect in conjunction with recent developments in tunable coherent laser sources offers promise for increased sensitivity and specificity in the detection of ambient gaseous components. Low temperature matrix procedures, ordinarily used to characterize unstable molecular systems, may possibly be adapted for the study of gaseous species occurring in low concentrations in a controlled environment. The technique has the potential for improving instrumental analysis of odorants.

49019 **APTIC NO. 71177**

Lindvall, Thomas

SENSORY EVALUATION OF ODOR INTENSITY AT THE SOURCE AND IN THE AMBIENT AIR. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.), New York, Academic Press, 1974, p. 143-162. 74 refs.*

Sensory methods for odor intensity evaluation at the source and in ambient air are reviewed. Stimulus presentations for source evaluations can be performed using the method of limits, the method of adjustment, the method of constant stimulus, or methods based on the theory of signal detectability. The method of limits, where stimuli are presented in alternating ascending and descending series starting at different points, is the most direct method for establishing an absolute threshold. Either direct or indirect methods may be used for category scaling. In both cases the expermental data consist of the quantitative evaluations by the test subjects which are then converted to psychological perception scale. For the evaluation of ambient odorous pollutants, data concerning odorant dose can be collected by three different methods: the prognosis method which is based on meteorological calculations and source strength, the retrospective method which involves interviewing residents to find out their retrospective opinions about odor frequency and duration, and the prospective method which is based on consecutive observations of odor occurrence within a given area for a fixed period of time. Sensory source intensity analyses combined with meteorological dispersion calculations have been successfully used to predict the frequency with which odors are discernible in the ambient air at various distances from a pulp mill.

49020 **APTIC NO. 71382**

Lorenz, Gerhardt

METHOD OF AND APPARATUS FOR USE IN MEASURING THE PARTICLE SIZE DISTRIBUTION AND/OR THE CONCENTRATION OF PARTICLES IN SUSPENSION IN A GASEOUS DISPERSING MEDIUM. *(Sartorius-Membranfilter GmbH, Gottingen (Germany)) U. S. Pat. 3,825,345. 8p., July 23, 1974. 5 refs. (Appl. March 19, 1973, 19 claims).*

A method and apparatus based on atomic absorption are described for measuring the particle size distribution and particle concentration in aerosols. The aerosol particles are singly introduced into the evaporating zone of an atomic absorption spectrometer. The output signal of a photo-multiplier of the spectrometer is applied to a pulse rectifier which transmits the rectified signal to a multi-channel amplitude analyzer associated with a counter in the output of each channel. This method is particularly suitable for the detection of heavier elements. Conventional emission techniques are not sensitive in this region.

49021 **APTIC NO. 71148**

Matsuda, Y., A. Mizohata, and T. Mamuro

SIMULTANEOUS ANALYSIS OF GASEOUS AND PARTICULATE SULPHURS IN THE ATMOSPHERE BY X-RAY FLUORESCENCE SPECTROMETRY. *(Taikichu kitaijo oyobi ryushijo io no keiko X-sen bunsekiho ni yoru doji bunseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):190, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Sulfur compounds in particulates in air were collected by conventional filter paper and sulfur dioxide gas was sampled by filters impregnated with aqueous solutions of sodium hydroxide (5%) plus glycerin (5%) or NaOH (20%) plus triethanolamine (10%). The particulates and SO2 gas were simultaneously analyzed by X-ray fluorescence spectrometry with Fe-55 as excitation source, Si(Li) semiconductor detector, and multi-channel wave height analyzer. Standard SO2 from a generator was used for correction of the analysis. Continuous analysis was possible by using an automatic sampler exchanger.

49022 **APTIC NO. 71013**

McEwan, William S. and Charles M. Drew

METHOD FOR MEASURING LIQUID PARTICLE DISTRIBUTION FROM FOGS, CLOUDS, AND SPRAYS. *Dept. of the Navy, Washington, D. C.) U. S. Pat. 3,820,953. 3p., June 28, 1974. 4 refs. (Appl. Oct. 18, 1972, 3 claims).*

A fallout meter device for particle size distribution measurements of fogs, clouds, and aerosol sprays is described that, unlike prior-art fallout meters, achieves sharp particle outlines even in the presence of large amounts of precipitation. The invention consists of a smooth metallic mirror on a substrate of suitable composition such as plastic or glass. The type of metal used depends on the composition of the droplets being studied. The surface of the film is exposed to a fog, cloud, or spray for a predetermined length of time causing droplets to adhere to the surface and form signatures. After the signatures set for a predetermined length of time, the surface of the apparatus is treated with a drying agent. The apparatus can then be sealed to provide a permanent record of the size distribution.

49023 **APTIC NO. 70456**

Melngailis, I. and A. Mooradian

TUNABLE SEMICONDUCTOR DIODE LASERS AND APPLICATIONS. *Preprint, Massachusetts Inst. of Tech., Lexington, Lincoln Lab., 67p., Aug. 1974. 78 refs.*

The present state of the art and future potential applications of diode lasers based on wavelength tunability are summarized. Recent advances in lead-salt diode laser technology and the resulting improvement in performance are described, including the use of stripe-geometry and heterostructures. Tuning by means of magnetic field, hydrostatic pressure, or temperature variation, as well as by the use of an external cavity equipped with a grating tuner are discussed. Applications in high resolutio absorption measurements and gas detection including the use of heterodyne radiometry and spectrophone techniques are described. Diode lasers, because of their tunability, narrow spectral linewidth, high degree of stability, low input power requirements, and structural simplicity, have a very significant potential for application in a number of emerging areas of technology and basic research such as high resolution gas spectroscopy, tunable local oscillators in communications or radar systems involving carbon dioxide or other high-power laser sources, tunable local oscillators in heterodyne detection of emissions from pollutant gases or from astronomical sources, and in photochemistry where tunable sources of sufficient power could be used for studying or initiating chemical reactions or in isotope separation. (Author conclusions modified)

49024 **APTIC NO. 70814**

Michels, Donald E.

ANALYSIS OF PAIRED DATA SEQUENTIAL IN SPACE OR TIME AND THE RELATIONSHIP TO SAMPLING CONTINUOUS CYCLIC DISTRIBUTIONS. *Dow Chemical U.S.A., Golden, Colo., Health Physics Research Group, Atomic Energy Commission Contract AT(29-1)-1106, 12p., Aug. 5, 1974. 9 refs.*

NTIS: RFP-2165

A series of 25 soil samples taken along a line shows levels of cesium-137 that conform to a continuous cyclic distribution function for fallout. Samples close to one another tend to be similar in Cs content, with the contents being more similar as the spacing is reduced. Similarity in content versus proximity indicates that the half-cycle length of the distribution function is greater than 1 m, though possibly less than 2 m. Three statistical quantities, classical variance, variance between adjacent pairs of samples, and variance of replicate aliquots, are used to quantify the relationship between proximity and similarity. The difference between variance for samples of a set and variance for multiple analyses of a single sample define the maximum amount of information obtainable from the set; although for pairs of samples adjacent in the sequence, variance has an intermediate value. The resolution of the set of samples depends on where the variance for adjacent pairs fits in the range bounded by the other variances. The resolution actually obtained can then be compared with a desired resolution in order to decide whether resampling is required, worth the cost, or whether a new analytical method is needed. A sampling method is described based on the standard deviation of single samples and the cycle dimensions of the distribution function. The method specifies a minimum separation between samples and tells how many samples of a given size must be composited to achieve a desired level of accuracy in sampling. (Author summary modified)

49025 **APTIC NO. 70613**

Minase, Koichi

THE APPLICATION OF REMOTE SENSING FOR LARGE AREA ENVIRONMENTAL INVESTIGATIONS. *(Koiki knakyo chosa ni tsuite no rimoto senshing no tekiyo). Text in Japanese. Denryoku Keizai Kenkyu (Power Econ. Stud.), no. 5:111-121, March 1974.*

The technique of remote sensing which is indispensable to large area environmental investigations such as the case of site planning for atomic or thermal power plants is described. Remote sensing is defined as a sensing method for objects or gathering information about such objects by means of electromagnetic wave radiation or energy reflection. The nature of the electromagnetic wave and its application to remote sensing are discussed. Remote sensing is classified into several categories according to the type of sensing device, the receiving method of information, and the information processing method such as the image method which includes photographic and nonimage methods. A brief description of identification method of object by photographic image in which the object is identified by its characteristic reflection is given. Examples of spectral radiance of green vegetation, sandy soils, and muddy river water and variation in spectral radiance with the type of trees are shown in diagrams. The plant activity in terms of the water content can be measured by spectral radiance. The nonimage method is described in which the information is automatically processed by machines. The present status of remote sensing in Japan, U.S.A. and Canada are reviewed. The Earth Resources Technology Satellite and other satellites can be used for remote sensing.

49026 **APTIC NO. 71107**

Mizuta, H., K. Terasawa, K. Ishihara, K. Hirano, S. Karasawa, M. Suzuki, Y. Yoshinaga, M. Kitazume, Y. Endo, and E. Yoneyama

DESIGN OF HIGH-VOLUME AIR SAMPLER FOR THE ANTARCTIC. *(Haiboryumu ea sanpura no kyokuchi ni okeru shiyo rei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):254, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 115.*

A high volume air sampler is modified for use in the Antarctic. The shelter employs screening plates to prevent snow suction, and coats of paint prevent corrosion of the sampler. Operation of the sampler was at temperatures between -7 C to +4 C and at wind velocities around 10 m/sec, except on blizzard days. The dust concentration in ocean air samples was 0.004 to 0.05 mg/cu m; its composition was mostly sodium chloride aerosols, which were identified by X-ray analysis or electron microscopy. The dust concentration around the Antarctic Base was 0.003 mg/cu m, which is mainly the dust accompanied by base operation and some weathered rock dusts. The dust collection efficiency of modified and non-modified samplers was compared, and the modified sampler was 2.5% less efficient, possibly because of the screening plates employed.

49027 **APTIC NO. 70457**

Mooradian, A., A. S. Pine, and N. Menyuk

DEVELOPMENT OF TUNABLE SEMICONDUCTOR LASERS FOR APPLICATION TO AIR POLLUTION MEASUREMENTS. *Massachusetts Inst. of Tech., Lincoln Lab., National Science Foundation Progress Rept. NSF/RANN/IT/ GI34990/PR/74/2, 13p., 1974.*

A program to study the properties of optically-pumped semiconductor lasers in the mid-infrared (3-5 micron) to evaluate their potential as spectroscopic sources for air pollution monitoring is described. Limited availability of diode lasers adequate for spectroscopy is presently a drawback of both a high-temperature pressuring-tuning program and the low-temperature current-tuning programs for air monitoring. Therefore the present project was undertaken to assess the spectroscopic capabilities of optically-pumped semiconductor lasers at low temperatures. Such lasers can be much more readily fabricated than diodes, and semiconductor materials can be used which are not under active diode development, thus opening up new spectral regions. During the program, CW laser emission was obtained from optically pumped indium arsenic (3 micron) and indium antimony (5.3 micron) and narrow-linewidth pulsed operation from tellurium (3.8 micron) at liquid helium temperatures. The CW operation, achieved for the first time with pumping light both near and well above the bandgap of the semiconductor, has great potential for spectroscopic application. The emission characteristics of the semiconductor lasers for such resonant and nonresonant pumping are described. The primary conclusion from the work performed so far is that CW lasing emission with sufficient stability for infrared spectroscopy can be obtained from semiconductors at liquid helium temperatures by optical pumping.

49028 **APTIC NO. 71226**

Mooradian, A.

RECENT DEVELOPMENTS IN HIGH RESOLUTION TUNABLE INFRARED LASERS. *Inst. of Electrical and Electronics Engineers, New York, IEEE (Inst. Elec. Electron. Engrs.) Region Six Conf. Proc., p. 79-87, 1974. 21 refs.*

Some recent developments in the technology of tunable sources which operate in the near to middle infrared regions are described. Included are external cavity controlled and hydrostatic pressure tuned semiconductor lasers, spin-flip Raman lasers, and nonlinear mixing using tunable and quasitunable laser sources. The spectral linewidth and tuning range of these devices are discussed, with emphasis on their application for high resolution spectroscopy. Application of a device based on nonlinear mixing of carbon dioxide laser radiation in chalcopyrite crystals would be quite useful and practical for laser induced chemical reactions, isotope separation, pollution detection, ordinance effluent detection, and aircraft exhaust identification. (Author abstract modified)

49029 **APTIC NO. 70305**

Nagase, M. and H. Ota

DETERMINATION OF LOWER FATTY ACIDS IN ODORS. *(Akushu to shite no teikyu shibosan-rui no sokuteiho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):457, Nov. 1974. 3 refs. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 308.)*

Analysis of lower fatty acids was conducted by selective absorption of these acids in sodium hydroxide solution, and collection of the resultant sodium salts. The sodium salts were acidified with formic acid, and the regenerated fatty acids were analyzed by gas chromatography. As an internal standard, trans-crotonic acid was used. Malodors emanating from a pig manure drying installation were analyzed, and six fatty acids (acetic, propionic, iso-butyric, n-butyric, iso-valeric, n-valeric) were detected without difficulty. Recovery was nearly 100% for all of the acids.

49030 **APTIC NO. 70301**

Nagata, Y., N. Takeuchi, T. Ishiguro, T. Hasegawa, and Y. Shigeta

STUDY OF RELATIONSHIPS ETWEEN ODOR INTENSITIES AND CONCENTRATIONS OF ODORANTS Y ODOR-FREE ROOM METHOD. *(Mushushitsuho ni yoru akushu no busshitsu nodo to shuki kyodo oyobi fukaido to no kankei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):452, Nov. 1974. 2 refs. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 302.)*

Five malodors (hydrogen sulfide, methyl mercaptan, methyl sulfide, ammonia, and trimethylamine) were smelled by a six-member panel to determine relationships between odorant concentration and odorant intensity as well as degree of unpleasantness. An odor-free room with six smelling windows was used. Odor intensities were evaluated on a scale of 6. A logarithmic relationship was found between odorant concentration and intensity, and between odorant concentration and degree of unpleasantness.

49031 **APTIC NO. 71458**

Nakano, K. and K. Masuda

COMPARISON OF NON-METHANE HYDROCARBON ANALYSERS. *(Hi-metan tanka suiso sokutei no hikaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):204, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 61.)*

The performance of five types of commercial non-methane hydrocarbon analyzers was tested according to the manufacturers instructions using standard gas and air samples. Comparisons were made on the basis of measurement method, measurable component, concentration calculation method, carrier gas, span gas, measurement cycle, and propane response. Using several types of gaseous mixtures of CH4 and air (non CH4 HC content, 0.1 ppm), the calibration curves were prepared. Linear lines passing through the origin were obtained in all cases for CH4. As for the total HC measurement the linear line deviated from the origin in two out of three analyzers. The propane response of analyzers was measured using gaseous mixture of C3H8 and air (2.5-3.0 ppm), and the result varied in the range of 64-104%. The non-CH4 HC concentration of air samples measured varied greatly with the type of analyzer, indicating the necessity for reduction in differences in response. As for CH4 measurement, results were satisfactory in all five analyzers.

49032 **APTIC NO. 70636**

Nakao, S. and S. Momose

AOUT THE SAMPLING AND ANALYTICAL METHODS FOR HCL IN MOISTENED EXHAUST GASES. *(Endo haigasu ni okeru enka suiso no sanpuringu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):434, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 285.)*

Experiments were carried out to study the effect of heating the sampling apparatus and the possibility of a long distance sampling method. A sampling tube connecting the sampling bottle and the stack was heated at a desired temperature, and hydrogen chloride in the exhaust gas was analyzed by the JIS-K-0107 silver nitrate method. The HCl distribution varied with the heating method. When heat was applied on the tube covering the portion in the stack wall, more than 90% of the HCl was collected in the first sampling bottle while a few percent remained in the tube. Without heat, about 90% of the HCl remained in the tube, with the rest collected in sampling bottles. Long distance (remote) sampling up to 60 m was possible.

49033 **APTIC NO. 70970**

Nishino, Shozo

ON MEASUREMENT OF WASHING OIL VAPOR IN AIR. *(Taiki-chu no kikai senjoyu joki no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):208, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 65.)*

Sampling and analysis methods for measurement of oil vapor concentration in a machine assembly plant were studied. The properties of washing oil used in the plant were specific gravity, 0.799, distillation range, 10% at 198 C, 50% at 213 C, 90% at 241 C, and dried at 274 C, composition, saturated hydrocarbon, 88.4%, aromatic HC, 10.71% and resin 0.89%. The experimental oil vapor sampling apparatus consists of an air pump, a three-necked flask equipped with stirrer containing the oil sample, three sampling bottles containing carbon tetrachloride and potassium balls, an activated charcoal sorption column, and a vacuum pump serially connected. The collecting efficiency of three CCl4 solutions was 90% for the first, 9.9% for the second, and less than 0.1% for the third. The CCl4 solution was concentrated under reduced pressure, infrared absorbancy was measured at 2962/cm, and the concentration per one N cu m of air was calculated using the calibration curve. The oil vapor concentrations measured were 91-587 mg/N cu m in a laboratory test and 104-107 mg/N cu m for samples collected at the plant.

49034 **APTIC NO. 71082**

Norval, E. and L. R. P. Butler

TRACE METALS IN MAN S ENVIRONMENT AND THEIR DETERMINATION BY ATOMIC ABSORPTION SPECTROSCOPY. *S. African Med. J. (Capetown), 48(63):2617-2626, Dec. 28, 1974. 129 refs.*

The environmental and occupational occurrence of trace metals, their toxicity to humans, and their detection by atomic absorption spectroscopy are reviewed. Industrial and non-industrial sources are outlined for lead, mercury, cadmium, iron, chromium, manganese, vanadium, nickel, zinc, arsenic, and beryllium. Atomic absorption spectroscopy is cited as useful in defining the precise functions of metals in metabolism, diagnosing pathological conditions, and defining maximum allowable concentrations in air and other media. The high sensitivity of the flameless atomic absorption technique is especially suitable for determination of metallic elements in air samples because of the limited amount of impinged air required for the measurement. The maximum permissible level of airborne lead, for example, established by the World Health Organization (2 micrograms/cu m) is well within the capability of atomic absorption measurement.

49035 **APTIC NO. 71147**

Numakawa, M., S. Sato, and K. Ishizuka

A COMPARISON OF NASN AND SEOUL PBO2 METHODS FOR THE DETERMINATION OF SOX. *(PbO2 ho niyoru SOx sokuteiho ni okeru NASN ho to SEOUL ho no hikaku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):189, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Candles for the shelters of NASN and SEOUL methods (Korea), were coated with 8 g of lead dioxide prepared by conventional methods. The coatings were dried for one month and the candles were placed in the respective shelters. The shelters were then exposed to the air on the roof of the Kawasaki Health Center from February 1973 for 14 mo. The sulfur oxides concentrations obtained by NASN method ranged from 0.94 to 1.71 mg sulfur trioxide/day/sq cm PbO2 with an average of 1.304 mg SO3/day/sq cm PbO2, while those obtained by SEOUL method ranged from 0.79 to 1.46 mg SO3/day/sq cm PbO2 with an average of 1.055 mg SO3/day/sq cm PbO2. The difference was 21-28% by statistical analysis.

49036 **APTIC NO. 71443**

Oishi, S. and K. Imagami

A STUDY OF CONSTITUENT ANALYSIS OF DUSTS BY ION MICROANALYZER. *(Ion maikuro anaraiza ni yoru funjin no sosei bunseki ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):226, Nov. 1974. 1 ref. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 85.)*

A ion microanalyzer was used to quantitatively determine amounts of trace metals in dust from the sintering furnace of a steel plant. Dust was collected with an electrostatic precipitator and formed into tablets (about 10 mm phi) for analysis. For vanadium, nickel, and chromium, results of chemical analyses (atomic absorption spectra and colorimetry) agreed well with results obtained with ion microanalyzer, in concentration ranges of 53-280 micrograms/g.

49037 **APTIC NO. 70968**

Oka, M., T. Nakakoi, T. Kamiura, T. Kitamura, and S. Suzuki

THE PREPARATION AND ANALYTICAL METHOD OF STANDARD MATERIAL PAN. *(PAN no hyojun bushitsu no chosei to bunsekiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):207, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 64.)*

The peroxyacyl nitrate obtained by the photochemical reaction between trans-2-butene and nitric oxide, purified, and identified by infrared spectroscopy, was absorbed in benzene in an impinger and used as a standard solution. For the determination of PAN in a standard solution, 0.1 N sodium hydroxide solution was added and the nitrite ion produced was determined by the naphthylethylene diamine method. By diluting the standard solution obtained, the calibration curve for electron capture detector gas chromatographic determination was prepared. The linearity of the curve and sensitivity were satisfactory. Examples of ECD gas chromatogram and nuclear magnetic resonance chart of PAN in benzene solution are given. The stability of PAN in C6H6 solution deteriorated after several hours.

49038 APTIC NO. 71459

Oka, M., T. Nakadoi, T. Kamiura, and M. Tanaka

COMPARATIVE MEASUREMENT OF NON-METHANE HYDROCARBONS. *(Hi-metan tanka suiso sokutei hoshiki no hikaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):203, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 60.)*

Comparative studies were made on the direct and differential gas chromatographic determination methods for non-methane hydrocarbons. In the direct method using a column consisting of a hold column for HC with carbon number higher than six and a separatory column for oxygen and methane, non-CH4 HC was back-flashed for the direct measurement. Using a column 2.5 m in length at 54 C with nitrogen (40 ml/min) as carrier gas, the back-flash occurred at 135 sec after sample injection. The analysis cycle was 6 min. A phenomenon of slight tailing was observed in all cases of non-CH4 HC. The response ratio of various HC to CH4 by differential method and direct method (N2 carrier gas) were 0.83 and 1.05 for acetylene-ethylene mixture, 0.77 and 1.01 for propane, 0.56 and 0.93 for propylene, and 0.74 and 0.98 for toluene, respectively. In the latter method, the variation in response ratio due to HC type was extremely slight.

49039 APTIC NO. 70963

Okita, Toshiichi, Yukio Takizawa, Koei Minagawa, Ryuichi Sugai, and Ikuei Kifune

DETERMINATION OF PCB AND PCT IN THE ATMOSPHERE USING FILTER PAPER. *(Roshi-ho o mochiita taikichu PCB, PCT no sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):214, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 71.)*

A simple, expedient, and simultaneous measurement method for polychlorinated triphenyls and polychlorinated biphenyls produced by incineration is described. Sampling by glycerine-coated glass fiber filter was evaluated, and measurements were made. The recovery rate of the pollutants from the glycerine-coated glass fiber filter measured by alkali decomposition, n-hexane extraction, separation by column chromatography, and electron capture detector gas chromatography was in the range of 95-100%. Using filters placed in series, the variation in collection efficiency was measured by varying flow rate and glycerine content. The collection efficiency of the first filter in the series was 100% and 96-98%, according to brand name. Atmospheric PCB and PCT can be collected with 100% efficiency using an 8 by 10 in. filter at a flow rate of 100 l/min. The atmospheric PCB concentration measured was in the range of 0.04-0.15 ng/cu m.

49040 APTIC NO. 71144

Okita, T., S. Morimoto, and S. Konno

DETERMINATION OF GASEOUS AND PARTICULATE NO3 IN THE ATMOSPHERE BY FILTER METHOD. *(Roshiho o mochita taikichu no ryushijo gasujo NO3 no bunseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):195, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Toyo 51 A filter paper and glass fiber filter paper were immersed in 5% NaCl solution and dried before use. The filter papers were employed for the collection of nitrate ions. 51 A filter paper for gaseous nitrate ion and glass fiber filter paper for gaseous nitrate ion and nitrate ion particulates. Air was sampled at 20-25 l/min for 1-2 hr and the nitrate ions were analyzed by Griess-Romijin reagent after being converted to nitrite ions. Peroxyacetyl nitrate and ethyl nitrate did not interfere with the determination. Measurements at Tokyo in the summer of 1973 revealed that intimate correlation exists between gaseous nitrate ion concentration and maximum oxidants concentration.

49041 APTIC NO. 71103

Okumura, T., H. Nakajima, K. Yagi, M. Amano, Y. Kishikawa, and K. Umeda

GAS CHROMATOGRAPHIC ANALYSIS OF BENZOPYRENE AND PHTHALIC ANHYDRIDE IN SUSPENDED PARTICULATES. *(Taiki fuyu ryushi chu no benzu piren oyobi musui futarusan no gasu kuromato gurafi ni yoru bunseki). Text in Japanese. Preprint, p. 5, 1974. (Presented at the Environmental Toxicology Symposium, 1st, Osaka, Japan, Nov. 21-22, 1974, Paper 5.)*

A simple and expedient gas chromatographic determination method for benzopyrene and phthalic anhydride in suspended particulates was developed. The suspended particulate sample was collected efficiently on glass fiber cylindrical filter (125 sq cm) of air sampler developed, extracted with benzene (2 hr), concentrated, and measured by gas chromatography. Benzopyrene and C6H4(CO)20 concentrations measured in Kitakyushu during the period of Nov. 1973 to Jan. 1974 were 45-128 micrograms/1000 cu m air and 32-181 micrograms/1000 cu m air, respectively.

49042 APTIC NO. 70966

Okuno, Toshihide, Masahiko Tsuji, and Kozo Shintani

ON THE CHLORINATED HYDROCARBON IN AIR. *(Taiki-chu no yuki enso kagobutsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):211, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 68.)*

Sampling and analysis methods were evaluated for measurement of concentrations of atmospheric chlorinated hydrocarbons, particularly chlorinated HC with 1-2 carbons. Air samples collected in an aluminum-coated bag were dehydrated by being passed through columns containing soda lime, calcium chloride, and phosphorus pentoxide; concentrated using liquid oxygen; and analyzed by electron capture and flame ionization gas chromatographs. Average concentrations over a period of several days measured in Kobe city were 0.3-9.4 ppb for chloroform, 0.7- 9.4 ppb for trichloroethylene, 0.06-0.48 ppb for carbon tetrachloride, 0.02-0.95 ppb for perchloroethylene, and 0.01-0.93 ppb for tetrachloroethane. Chromatographic measurement conditions and an example of a chromatogram are given.

49043 APTIC NO. 71497

Ono, Keizo

ON CHOICES OF EXHAUST GAS METERS. *(Haikigasu sokuteiki no sentaku ni tsuite). Text in Japanese. Jidosha to Seibi (Automob. Maint.), 28(12):58-76, Dec. 1974.*

New regulations concerning the emission of hydrocarbons from idling vehicles and emission of carbon particles from diesels require installation of control equipment and inspection to ascertain their effectivenes. New types of meters for hydrocarbons are characterized by a non-dispersive infrared process, they divide the region to be measured according to their particular use, they incorporate a two- or three-step switching method, and they are always accompanied by equipment for correction. Carbon monoxide meters are characterized by an NDIR process and the ability to measure concentrations an order of magnitude lower than previous meters. They are classified according to one of the two types of detectors employed: a normal hexane gas detector and a semiconductor-optical filter detector. New types of hydrocarbon and carbon monoxide meters are listed with their concentration ranges.

49044 APTIC NO. 70298

Onozuka, H., H. Fukushima, Y. Iwasaki, and I. Ishiguro

ON SENSORY TEST MEASUREMENTS OF LOW LEVEL ODOR STRENGTHS AT PLANT OUNDARIES. *(Shikichi kyokai ni okeru teinodo iki no kanno shikenho no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan.*

Soc. Air Pollution), 9(2):449, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 299.)

Low concentration odors at industrial plant boundaries were measured by means of a three-point comparison method, using plastic odor sampling bags (volume, about 7 l) encased in air-tight containers (volume, about 50 l). The containers were evacuated to less than 7 l of gas, and the odor samples were introduced into the sampling bags under reduced pressure during a 10-second period. Samples for testing were diluted with air to appropriate concentrations in 3-liter odor sampling bags.

49045 **APTIC NO. 71318**

Ootsuka, Y., S. Miyazaki, and Y. Himi

THE EXPERIMENTAL MODEL FLUE USED FOR STUDIES ON MEASURING METHOD OF DUST CONTENT IN STACK GAS. *(Endo haigasu-chu no baijin-ryo sokuteiho kenkyu-yo mogi endo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):426, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 277.)*

A flue model to be used as a standard for the measurement of particulate concentration was designed. Air containing known particulate concentration was produced and sampled in ducts of horizontal, vertical, and bent type. The flue model consisted of a 35 m by 155 mm inside diameter aluminum pipe as flue, a measurement section composed of a horizontal tube, a 90-degree bent tube and a vertical tube, a blower which supplied air at 18 cu m/min, a cyclone, and a bag filter. The advantages of the model include relatively large cross-sectional area and high average wind velocity.

49046 **APTIC NO. 71331**

Oskina, V. N.

EXPRESS METHOD FOR THE DETERMINATION OF CARBON MONOXIDE IN WORKPLACE AIR. *(Bystryy metod opredeleniya okisi ugleroda v vozdukhe proizvodstvennykh pomeshcheniy). Text in Russian. Gigiena i Sanit., no. 9:54-56, 1974. 4 refs.*

A method for the determination of carbon monoxide in the air is described. The air to be analyzed is passed through adsorbers containing silica gel and sodium hydroxide for the retention of impurities (especially aldehydes and hydrogen sulfide), and finally into a flask containing a silver nitrite and ammonia solution. Carbon monoxide is determined colorimetrically following the reduction of silver nitrite. The sensitiviity of the method, using standard samples for calibration, amounts to 0.1 mg.

49047 **APTIC NO. 71380**

Oswin, Harry, G. and Keith F. Blurton

GAS DETECTING AND QUANTITATIVE MEASURING DEVICE. *(Energetics Science, Inc., New York) U. S. Pat. 3,824,168. 8p., July 16, 1974. 2 refs. (Appl. June 16, 1972, 3 claims).*

An improved device for the electrochemical detection of and quantitative measurement of a gas in a given environment is described. The device is compact, inexpensive, and easy to operate. Small gas samples are used which permits the use of compact, portable units. The device can be modified or adapted for detecting and measuring carbon monoxide, hydrocarbons, including separation of saturated and unsaturated hydrocarbons; gases capable of being converted to alcohols, CO, or hydrocarbons; or other gases which can be electrochemically consumed. An accurate reading is obtained without reaching a steady state condition as a result of rapid response time obtained through the use of an electrochemical cell with a very low internal resistance.

49048 **APTIC NO. 71400**

Oswin, Harry G. and Keith F. Blurton

GAS DETECTING AND MEASURING DEVICE. *(Energetics Science, Inc., New York) U. S. Pat. 3,824,167. 10p., July 16, 1974. 8 refs. (Appl. Aug. 17, 1971, 16 claims).*

A device for the electrochemical detection of and quantitative measurement of a gas in a given environment, such as carbon monoxide in the atmosphere, is described. The device is compact, inexpensive, and easy to operate. It provides a simple and rapid method for determining and monitoring polluting gas levels in the atmosphere and can be used along the road to measure exhaust emissions. The device can be modified or adapted for detecting and measuring hydrocarbons including separation of saturated and unsaturated or smog hydrocarbons, gases capable of being converted to alcohols, carbon monoxide, or hydrocarbons, or other gases which can be electrochemically consumed.

49049 **APTIC NO. 70928**

Pilat, Michael J.

MEASUREMENT OF PARTICLE SIZE DISTRIBUTIONS AT EMISSION SOURCES WITH CASCADE IMPACTORS. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 709-730. 19 refs. (Jan. 15-18, Paper 30.)*

A cascade impactor capable of providing submicron particle size data is described. The impactor has a single-jet first stage followed by six multi-jet stages and a 47 mm filter holder. The particle collection plates have a hole in their centers for the gas to flow through, thus eliminating the need for the gas to flow around the outside edges of the plate. Annular particle collection plates prevent particle loss of the cylindrical walls of the outer casing. Good agreement is observed between in-stack particle mass concentrations measured with the cascade impactor and an alundum thimble (correlation coefficient of 0.94). The sampling of gases containing water droplets can be achieved by placing filters on the particle collection plates if the water concentration is low or by using a long heated inlet nozzle if water concentrations are high. The impactor appears capable of measuring submicron particle sizes down to 0.02 micron, assuming that a good portable vacuum pump is used.

49050 **APTIC NO. 71134**

Roess, Dieter

SYSTEM FOR THE OPTICAL MONITORING OF AIR POLLUTANTS IN A LARGE SPACE. *(Siemens Aktiengesellschaft, Berlin and Munich (West Germany)) U. S. Pat. 3,820,897. 6p., June 28, 1974. 7 refs. (Appl. June 19, 1972, 7 claims).*

A laser-Raman spectrophotometric method for the remote detection of air pollutants (e.g., sulfur dioxide and carbon monoxide) over large, inaccessible areas is described. Several laser transmitting stations and corresponding receiving stations are spatially arranged to allow for larger coverage than has been obtained previously. The transmitting and receiving stations may be arranged along a common line, with each transmitting station being situated adjacent to a cooperating receiving station, or on spaced lines. In the latter case, all transmitting stations are arranged to transmit beams of rays extending in a common radiation plane, and each receiving station is situated to receive return reflected radiation from the cooperating transmitting station. Transmission and receiving stations may also be situated, in conjunction with several beam dividers, so that the transmitted and received beams form a matrix- configurated network. (Author abstract modified)

49051 **APTIC NO. 71429**

Simecek, Jaroslav

PRACTICAL EXPERIENCE WITH THE TWO STAGE DUST SAMPLER DP-20. *(Praktische Erfahrungen mit dem zweistufgen Staubmessgeraet DP-20). Text in German. Staub, Reinhaltung Luft, 34(12):452-456, Dec. 1974. 9 refs.*

Dust content at industrial plants was sampled and determined by the standard gravimetric method (single-stage) and by the two- stage dust sampler DP-20. Three parameters were used in the assessment: total dust concentration, respirable dust concentration, and respirable dust content of the total sample. The results of the total dust concentration measurements obtained by the two methods are comparable. The advantages of the two- stage sampling for monitoring hygienic conditions are discussed.

49052 **APTIC NO. 71444**

Sugimae A., K. Sakihara, S. Hanai, and Y. Matsuo

TRACE METALS IN AIRBORNE PARTICULATES (15). SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS OF ELEMENTS IN AIRBORNE PARTICULATES. *(Fuyu funjinchu no kinzoku seibun (Dai-15-ho). Supaku iongen shitsuryo bunsekiho ni yoru funjinchu no zen genso bunseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):225, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 84.)*

Airborne particles, captured on membrane filter, were treated with acetone, dried, molded into electrodes, and analyzed for various elements by means of spark source mass spectrography. Silver was used as an internal standard, and about 50 elements were quantitatively determined at the same time. Only about 10 mg of test material are necessary for analysis.

49053 **APTIC NO. 70967**

Takeuchi, J., A. Kamiya, H. Mizutani, and T. Miyamoto

MEASUREMENT OF CHLORINE IN THE ATMOSPHERE. *(Taiki-chu no enso sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):210, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 67.)*

The method of using sulfanic acid solution as an absorbent for the measurement of atmospheric chlorine concentration was evaluated in comparison to the commonly used o-tolidine method. Air samples were collected using an impinger containing 5 ml of 0.05-0.2% aqueous H2NSO2OH or p-toluenesulfonamide solution. In this case, the collecting efficiency was above 90% at a flow rate of 2 l/min and higher at a lower flow rate; it decreased with an increase in flow rate in the case of Cl4H16N2 method. The Cl2 collected in H2NSO2OH solution is extremely stable and not affected by exposure to heat, air, and light. The Cl2 concentration collected by the Cl4H16N2 method decreased markedly with exposure to light. The variations in coloration of sample solution by the addition of o-Cl4H16N2 reagent with time and concentration of the reagent were investigated by measuring absorbancy. The maximum coloration was attained at about 5 min after the addition of reagent and maintained for longer period of time compared to the case of o-Cl4H16N2 method, when the concentration was above 0.005%. Interference by sulfur dioxide was eliminated by the addition of hydrogen peroxide, and nitrogen dioxide is removed by the reaction with H2NSO2OH.

49054 **APTIC NO. 71145**

Tanigawa, T., Y. Hayashi, S. Yonezawa, and Y. Kozai

THE TROUBLE ON MONITORING SULFUR DIOXIDE MEASUREMENT BY CONDUCTIVITY METHODS. *(Dodenritsuho ni yoru SO2 kankyo nodo sokuteijo no mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):187, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

The effects of temperature, humidity, and evaporation on the measurement of sulfur dioxide by the conductivity method were investigated. Standard SO2 gas was placed in an impinger and the temperature of the chamber was varied. Correction of the indicating values due to temperature was necessary. Gas having constant SO2 concentration (7.4 pphm) was used to study the effects of humidity and evaporation at constant temperature. The indicating value decreased 0.95% when humidity increased 1%. Moisture in the tubing absorbed a large quantity of SO2.

49055 **APTIC NO. 70643**

Heusden, S. van

CHEMILUMINESCENT OZONE, NO AND NO2 DETECTORS. *(Ozon-, NO- en NO2-detectors gebaseerd op chemiluminescentie). Text in Dutch. Chem. Weekblad, 70(27):15-18, July 5, 1974. 9 refs.*

Autonomous apparatuses for the measurement of the ozone, nitric oxide and nitrogen dioxide concentrations in the air by chemiluminescent technique, developed for use in the Dutch air quality monitoring network, are described. One ozone detector, using ethene for the chemiluminescent reaction of ozone, has a maximum at 420 nanom, and has a detection range from 2 ppb to 1,000 ppm. The error amounts to 3%, and the time required for measurement can be reduced to 0.1 sec. Another ozone detector uses gallic acid with Rhodamine on silicagel for the chemiluminescent reaction with an emission maximum at 560 nanom. This detector can be used for a concentration range of 0.1 ppb to 400 ppb. Normal concentrations of sulfur dioxide, nitric oxide nitrogen dioxide, methane, carbon monoxide, and carbon dioxide do not interfere with the determination. A chemiluminescent detector for the joint determination of NO and NO2 oxidizes NO to NO2 by means of ozone, while the NO2 originally present in the air is reduced to NO for the determination of the total nitrogen oxide content at an emission peak at 1200 nanom. No interference due to SO2, CH4, O3, CO, or CO2 was observed. The range of measurement extends from 2 ppb to 50 ppm. Another chemiluminescent analyzer for ozone, NO, and NO2 uses gallic acid and Rhodamine for the determination of ozone, while NO2 is decomposed to NO and native oxygen and further to O3 by photolysis under ultraviolet irradiation, and NO is oxidized to NO2 by a solid reagent for subsequent reaction to ozone. The limits of detectability are 0.5 ppb for nitrogen oxides and 0.1 ppb for ozone, the upper limit being 150 ppb. All these chemiluminescent detectors comprise photomultipliers and are suitable for autonomous operation for 2-3 mo.

49056 **APTIC NO. 70748**

Wessely, Istvan

THE NEVIKI DAPOMAC DATA ACQUISTION SYSTEM FOR AIR POLLUTION MONITORING. *(A neviki dapomac meresadatgyujtoje a levego szennyezeseinek mereseben). Text in Hungarian. Magy. Kem. Lapja (udapest), 19(8):426-429, 1974. 6 refs.*

A computerized data acquisition system (DAPOMAC NORX 211) for air pollution monitoring is described. The computer combines the techniques of high-precision analog circuits with the high resolution of digital circuits to attain quick operation and digital display. the computer utilizes a fixed program and thus does not require previous training for its operation. The system is schematically illustrated with a block diagram.

49057 **APTIC NO. 71181**

Weurman, C.

SAMPLING IN AIRBORNE ODORANT ANALYSIS. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.) New York, Academic Press, 1974, p. 263- 328. 106 refs.*

Sampling techniques for airborne odorant analysis are reviewed. The main types of sampling considered include direct sampling in which samples are taken for immediate gas-liquid chromatographic analysis of the odorant components, cumulative sampling involving the isolation of odorants from larger volumes of air preceding chromatographic analysis, and selective sampling for specific chemical groups of odorants collected for subsequent analysis. Various methods of product vapor, open-air vapor, and aerosol vapor sampling are covered under the main sampling methods. Other topics reviewed include: the reproducibility and accuracy in quantitative vapor sampling, the necessity for organoleptic tests in practical odorant studies, and vapor dilution methods for determinations of the efficiency of procedures for odorant cumulation.

49058 **APTIC NO. 71044**

Yamaki, Naoomi

TECHNIQUES OF ATMOSPHERIC POLLUTION PREVENTION MEASUREMENT. *(Taiki osen keisoku gijutsu). Text in Japanese. Sangyo Kogai Boshi Gijutsu (Ind. Pollut. Control Tech.), 1974:33-36, June 1974.*

Measurement methods for gaseous pollutants and suspended particulates are reviewed along with a discussion of the preparation of standard gases. Automatic methods for sulfur dioxide and nitrogen oxides are being developed. The Electrotechnical Lab is studying the electromagnetic determination and identification of minor components of air using electron impact ionization. The Institute of Environmental Pollution and Resources is studying the measurement of hydrofluoric acid, hydrogen chloride, carbon monoxide, nitrogen oxides, and hydrogen cyanide. It was recently found that almost complete collection of mercaptan and sulfite is possible by the use of a large excess of silver nitrate and that with 6 N HCl decomposition of the collected substances is possible to the extent of 94-100% for mercaptans, 99-100% for monosulfite, and 98% for bisulfite. These findings are being applied to determination by combined chromatography-mass spectral analysis. Dilution methods for standard gases are discussed.

49059 **APTIC NO. 71146**

Yatabe, T.

DETERMINATION OF LOW CONCENTRATION OF AIR POLLUTANTS. *(Taiki osen busshitsu no teinodo ryoiki no sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):188, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Correction of sulfur dioxide concentration obtained by AP meter was carried out. The values indicated by AP meter were affected by evaporation of absorbent, temperature, and humidity. The values obtained by rosaniline method with sulfite as standard were always 10% lower than those using SO2 standard gas. Correction was carried out by taking the above parameters into consideration. Calculation showed that the values obtained by AP meter were in good agreement with those of rosaniline meter after correction, both at high and low levels of SO2 concentration.

49060 **APTIC NO. 71149**

Yatabe, T.

DETERMINATION OF SULFUR DIOXIDE IN AIR BY FLAME PHOTOMETRIC DETECTOR METHOD. *(Enkokodo kenshutsuho (FPD ho) ni yoru taikichu no SO2 sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):191, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974.)*

Analysis of sulfur dioxide was carried out using flame photometric detectors from four manufacturers. The determination ranges of the detectors ranged from 0-0.1 ppm to 0-1.0 ppm and the rate of gas sampling ranged from 0.07 to 1.0 l/min. The zero drifts ranged from 0 to 0.5% for 24 hours and span drifts from 0.3 to 3.0% for 15 hours. Comparison with the results obtained by rosaniline method revealed that values obtained by the FPD method varied with the manufacturer. It is recommended that low concentration SO2 standard gas be determined by rosaniline method prior to the analysis, and special attention be paid to prevent the adsorption of SO2 on the heating tube.

49061 **APTIC NO. 71464**

Yavorovskaya, S. F. and K. M. Grinberg

GAS-CHROMATOGRAPHIC DETERMINATION OF METAL (BERYLLIUM, CHROMIUM, ALUMINUM) AEROSOLS IN THE AIR. *(Opredeleniye v vozdukhe aerozoley metallov (berilliya, khroma, al'uminiya) metodom gazovoy khromatografii). Text in Russian. Gigiena i Sanit., no. 11:54-57, 1974. 9 refs.*

A gas chromatographic method for the separate determination of beryllium, aluminum, and chromium aerosols in the air is presented. The model sample to be analyzed was combined with trifluoroacetylacetone and sodium acetate for the determination of the metals in the form of their chelates (trifluoroacetylacetonates). The sampling was done in a column filled with Celite 545 and 2% SE-30. A column temperature of 100 or 110 C, an electron capture detector temperature of 150 C, an evaporator temperature of 160 C, and nitrogen as carrier gas were used for the determination. The sensitivity amounted to 15 picograms for beryllium, 600 picograms for chromium, and 150 picograms for aluminum. The error was not greater than + or - 7%. The separate determination of beryllium, iron, cobalt, and nickel by this gas chromatographic method was possible by replacing trifluoroacetylacetone by another ligand. The sensitivity for beryllium was greater than that achieved by colorimetric method.

49062 **APTIC NO. 70300**

Yoshimoto, K., K. Koike, I. Kojima, Y. Hoshika, and S. Kadowaki

AN APPLICATION OF ODOR FREE ROOM FOR OFFENSIVE ODOR CONTROL SURVEY (2). *(Akushu kogai chosa no tame no mushushitsu no oyorei (sono 2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):451, Nov. 1974. 3 refs. (Presented at the 15th National Air Pollution Research Conference, Chiba, Japan, Nov. 6-8, 1974, Paper 3C1.)*

Sixty-eight lay persons who had taken a course in malodor detection were asked to smell five malodorous substances (ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide, and trimethylamine). Evaluation was attempted for any discernible relationships between substance concentration and odor intensity. An odor-free room, 10 cu m in volume, was used. Except for insensitive response to ammonia, the answers given by the lay panel in the middle odor intensity levels were not much different from those given by expert panels. There was high correlation between substance concentration and odor intensity for all five substances.

49063 **APTIC NO. 71081**

Yoshino, Masami and Takatoshi Tajima

VARIOUS PROBLEMS AND EXAMINATION OF ATMOSPHERIC RELATIVE HUMIDITY IN THE MEASUREMENT OF AEROSOL USING LIGHT SCATTERING RECORDER. *(Kosanran biryushi sokutei-ki ni toru SP sokutei no sotai shitsudo no mondai to sono kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):256, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 117.)*

The effect of atmospheric humidity on aerosol measurement by light scattering techniques is studied. The count on the dust indicator increased linearly up to the relative humidity 85% with a slope of about 0.7 count per deg C. However the count rapidly increased at a humidity above 85%, and the count at humidity 98% was 20 times the count obtained at a humidity of 60% resulting from the water mist effect on the light scattering. The effect of humidity on the aerosol analysis by low volume air sampler is also studied. The humidity gave a positive error in an aerosol weight concentration measurement; however it could be eliminated when the blank test was employed and its blank value was subtracted from the experimental value. The correlation factors between two techniques, light scattering and gravimetric analysis, on aerosol measurement was 0.75 to 1.43, depending on atmospheric humidities. Whenever the humidity was high, a negative correlation resulted.

49064 **APTIC NO. 70471**

Zlatkis, Albert

ANALYSIS OF VOLATILE ORGANIC COMPOUNDS. *Houston Univ., Tex., National Aeronautics and Space Administration Contract NAS9- 8260, NASA Case MSC-14428-1, 44p., 1974 (?). 1 ref.*

NTIS: N74-19776

A system for gas chromatographic analysis of a wide range of volatile organic compounds in air and water smaples, biological samples, body fluids and petroleum samples is described which permits greater speed, reproducibility, and composition discrimination than prior art devices. A porous polymer of 2,6-diphenyl-p-phenylene oxide is used as the adsorbent. The system includes a sample trap for capturing and enriching the organic volatiles, an injector port for directly injecting the entrapped organic volatiles into a cryogenic precolumn, and a capillary separating column. The solid adsorbent used in the sample trap has the following properties: high affinity for volatile organic compounds, hydrophobicity, temperature stability up to 400 C, good desorption capability, and relative inertness to the sample. The injector port is formed of a hollow body having inlet and outlet ports The sample trap is inserted into the body of the injector port and maintained in sealed engagement with the outlet port. The injector port is placed onto an injector heater of a gas chromatograph to effect desorption of the entrapped volatiles. Helium gas is introduced at the inlet port to carry the volatiles directly into the cryogenic precolumn. The gas chromatographic capillary separating column is formed of etched nickel which facilitates the separation of a large number of specific organic compounds from a very small amount of organic volatiles. Approximately 100 substances, almost exclusively hydrocarbons, were identified with the system suing air samples from various locations in the Houston area.

49065 **APTIC NO. 71452**

Zuyev, V. Y.

LASER DETECTION OF AIR POLLUTANTS. *(Lazernoye zondirovaniye zagryazneniy atmosfery). Text in Russian. Usp. Fiz. Nauk, 113(4):708-709, Aug. 1974.*

The possible uses of laser techniques for the detection of aerosols and gaseous air pollutants are described. High space resolution and very low susceptibility to error and interference are the main advantages of laser techniques in air pollution monitoring. The laser technique is suitable both for the quantitative determination of pollutant concentrations and for the study of pollution dynamics. One lidar of medium capacity suffices for pollution monitoring over an entire large industrial area and over emission sources by the utilization of the combination scattering.

49066 **APTIC NO. 70804**

Olsen Labs., Inc., Anaheim, Calif.

STUDY OF ULTRASONIC VORTEX EFFECT AND TRACER GAS METHOD ON MEASUREMENT OF AUTOMOTIVE MASS EMISSIONS (FINAL REPORT). *Coordinating Research Council, Inc. Contract, CRC-APRAC Proj. CAPE-22-72, 178p., 1974 (?).*

NTIS: PB 237112

The feasibility of two flow measuring techniques, one involving the injection of a tracer gas into the exhaust and the other utilizing an ultrasonic vortex flowmeter, was assessed in relation to measuring mass mobile source exhaust emissions. Each system was also evaluated in comparison to existing constant volume sampling systems. Direct exhaust flow measurement in conjunction with conventional gas analyzers appeared feasible for such measurements. The tracer gas method with nitrous oxide as the tracer was only marginally applicable for exhaust gas emission measurement with conventional gas analyzers, though utilization of a flowing reference cell could improve the accuracy of this technique. Mass hydrocarbon measurement by the ultrasonic vortex flowmeter showed a close correlation with the constant volume sampling method. Mass carbon monoxide and nitrogen oxide measurements with the ultrasonic vortex method displayed consistent, but offset, relationships to the constant volume method; the difference appeared due to imprecise compensation for sample and instrument time delays, CO levels below the accuracy range of the instrumentation, and differences between NOx measurements by nondispersive infrared and chemiluminescent methods used. These differences should be correctable by a more comprehensive computer program and cross calibration of instrumentation.

49067 **APTIC NO. 71224**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE METHOD OF TEST FOR CARBON MONOXIDE IN THE ATMOSPHERE (CONTINUOUS MEASUREMENT BY NONDISPERSIVE INFRARED SPECTROMETRY). *Book ASTM Stand., no. 26:656-659, 1974. 2 refs.*

A tentative method for the continuous measurement of atmospheric carbon monoxide by nondispersive infrared spectrometry is described. An atmospheric sample is introduced into the sampling system of a nondispersive infrared spectrometer; and the absorption of radiation by CO is measured by the difference method, using two parallel infrared beams and a selective detector. The detector signal is electrically transmitted to an amplifier control section, and the output is measured on a meter and recording system. Carbon monoxide concentration is determined for a calibration curve prepared from mixtures of standard calibration gases. The primary interferent is water vapor, and the error may be as high as 12 mg CO/cu m (10 ppm) if no correction is used. Water vapor interference can be minimized by using one of the following steps: passing the air sample through silica gel or a similar drying agent, maintaining constant humidity in the sample and calibration gases by refrigeration, saturating the air sample and calibration gases to maintain constant humidity, and using narrow band optical filters in combination with some of the above measures. The precision of the method is not yet established.

49068 **APTIC NO. 71231**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE METHOD OF ANALYSIS FOR FLUORIDE CONTENT OF THE ATMOSPHERE AND PLANT TISSUES (SEMIAUTOMATED METHOD). *Book ASTM Stand., no. 26:754-767, 1974. 9 refs.*

A semiautomated colorimetric procedure for the analysis of total fluoride in the atmosphere and other media (e.g., plant tissue) is described. The method incorporates microdistillation of the sample and may be applied to any fluoride-containing solution where standards of identical composition are carried through the same sample preparation procedures and are proven to provide quantitative recovery when analyzed by the semiautomated system. Atmospheric samples must be brought into solution and must fall within the calibration range of the instrument. Samples are analyzed sequentially with standard solutions which have a composition similar to the samples or with standards which provide the same recovery of fluoride. In either case, the method must be confirmed by a manual procedure. The semiautomated procedure involves pumping a sample slurry or solution and sulfuric acid into a polytetrafluoroethylene coil of a microdistillation device maintained at 170 C. A stream of air carries the acidified sample through the coil to a fractionation column. Fluoride and water vapor are condensed and pumped continuously from a distillate collector. Spent acid and solids are continuously removed as waste. Distillate is mixed continuously with a colorimetric reagent (alizarin fluorine blue-lanthanum) and passed through the flow cell of a recording colorimeter. The normal range of analysis is 0.1-4.0 micrograms F/ml. normal range of analysis is 0.1-4.0 micrograms F/ml.

49069 **APTIC NO. 71232**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE METHODS FOR ANALYSIS FOR FLUORIDE CONTENT OF THE ATMOSPHERE AND PLANT TISSUES (MANUAL PROCEDURES). *Book ASTM Stand., no. 26:735-753, 1974. 31 refs.*

Titrimetric, spectrophotometric, and potentiometric methods for the manual determination of fluorides in the atmosphere and other media (e.g., plant tissue) are outlined. Direct titration of fluoride with standard thorium nitrate solution can accommodate from 10 to 0.05 mg of fluoride in the total sample. Back titration modifications can measure from 50 to about 5 micrograms fluoride in the total sample. Direct titration can also be used for the lower ranges if photometric end point detection is employed. For the spectrophotometric detection of fluoride, both Zirconium-Eriochrome Cyanine R and Zirconium-SPADNS reagents obey Beer s law over the range from 0.000-1.40 micrograms of fluoride/ml with a detection limit of 0.02 microgram/ml. A Lanthanum-Alizarin Complexone procedure for the lower range covers from 0.00 to 0.5 microgram of fluoride/ml with a detection limit of approximately 0.015 microgram/ml. The spectrophotometric methods are temperature sensitive, and absorbances must be read within + or - 2 C of the temperature at which the respective calibration curve is established. The potentiometric determination of fluoride (inorganic) is achieved by diluting the alkaline sample solution containing atmospheric fluoride 1 + or - with a combined buffer (ionic strength adjuster and complexing agent) adjusted to pH 5.9-6.1 prior to analysis with a fluoride ion selective electrode. The potential corresponding to the fluoride ion concentration is measured in millivolts. The recommended range for analysis of air samples is between 0.1 and 10 micrograms/ml of fluoride in solution.

49070 **APTIC NO. 71241**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD DEFINITIONS OF TERMS RELATING TO ATMOSPHERIC SAMPLING AND ANALYSIS. *Book ASTM Stand., no. 26:264-270, 1974.*

Standard definitions adopted by the American Society for Testing and Materials for over 140 terms relating to atmospheric sampling and analysis are presented. The definitions cover: physical processes (e.g., absorption, agglomeration, precipitation); sampling and analysis instrumentation (e.g., bubbler, aspirator, soxhlet apparatus, flowmeter); types of atmospheric emissions (e.g., fly ash, odorant, mist, gas); measurement terminology (e.g., aliquot, mass concentration, odor unit); and various relevent physical parameters (e.g., temperature, pressure, settling velocity).

49071 **APTIC NO. 71242**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD RECOMMENDED PRACTICES FOR SAMPLING ATMOSPHERES FOR ANALYSIS OF GASES AND VAPORS. *Book ASTM Stand., no. 26:285-306, 1974. 8 refs.*

Practices recommended by the American Society for Testing and Materials that cover the sampling of atmospheres for gas and vapor analysis are presented. Two types of sampling methods are described: those for the analysis of relatively unreactive gases and those for the analysis of gases capable of reacting with dust particles, moisture, and sampling components. Topics covered include: the interval between collection and analysis; precautions against leaks; prefiltering for particulate matter; collection by absorption, adsorption, and condensation; and determination of sampler performance. Data are tabulated for characteristics of absorbers, specifications for air-purification activated carbon, retentivity of vapors by activated carbon, refrigerant temperatures, and properties of gaseous atmospheric contaminants. Various types of sampling devices are diagramatically illustrated.

49072 **APTIC NO. 71244**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE METHOD FOR SEPARATION AND COLLECTION OF PARTICULATE AND GASEOUS FLUORIDES IN THE ATMOSPHERE (SODIUM BICARBONATE- COATED GLASS TUBE AND A PARTICULATE FILTER METHOD). *Book ASTM Stand., no. 26:728-734, 1974. 6 refs.*

A method for the separation and collection of particulate and gaseous fluorides in the atmosphere is described. The method employs a sodium bicarbonate-coated glass tube and a membrane filter and is capable of collecting 2-500 micrograms of gaseous fluoride over a 12-hour sampling period at a sampling rate of 14.2 l/min (0.2-50 micrograms/cu m). The lower limit of detection is considered as twice the standard deviation of the monthly arithmetic mean blank value. The method involves removing gaseous fluorides from the air stream by reaction with sodium bicarbonate coated on the inside wall of a borosilicate glass tube. Particulate fluorides are collected on a filter following the tube. The fluoride collected on the tube is eluted with water or buffer and analyzed for fluoride, and the particulates collected by the filter are eluted with acid and then analyzed for fluoride. The results are reported as micrograms of gaseous fluoride and micrograms of particulate fluoride per cubic meter of air at 21 C and 760 torr pressure. Possible interferences include acid aerosols or gases which are capable of neutralizing or acidifying the bicarbonate coating and phosphates or metals such as aluminum which are capable of interfering with the subsequent analysis. Regarding the method s precision, the root mean square difference of duplicate bicarbonate-coated tubes within the range from 0.5- 3.3 micrograms fluoride/cu m is 0.051 microgram fluoride/cu m. Recovery of hydrogen fluoride is better than 95% for amounts of fluoride up to about 40 micrograms and for sampling periods of 15-120 min. Data on particulate fluoride are insufficient to establish recovery under field conditions.

49073 **APTIC NO. 71245**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE METHOD FOR CONTINUOUS SEPARATION AND COLLECTION OF PARTICULATE AND WATER-SOLUBLE GASEOUS FLUORIDES IN THE ATMOSPHERE (FILTER AND IMPINGER METHOD). *Book ASTM Stand., no. 26:721-727, 1974. 6 refs.*

A method for the continuous separation and collection of particulate and water-soluble gaseous fluorides in the atmosphere is described. The method utilizes a chemically treated filter and an impinger. Sampling rate may vary from 14.2 l/min for 24 hr to 28.3 l/min for 3 hr, depending on the atmospheric fluoride concentration. The procedure involves drawing air through an air inlet tube for passage through an acid-treated prefilter which removes particulates. The stream is then drawn through an impinger for the removal of water-soluble fluorides. The prefilter and impinger solutions are subsequently analyzed by potentiometric or photometric methods. Possible interferences include particulate metallic salts, phosphates, and metals such as aluminum. The precision and accuracy of the method are not yet established.

49074 **APTIC NO. 71256**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD RECOMMENDED PRACTICE FOR ROTAMETER CALIBRATION. *Book ASTM Stand., no. 26:690-693, 1974. 3 refs.*

Procedures for calibrating variable-area flowmeters (rotameters) used to determine air sample volumes at or close to ambient conditions of pressure nad temperature during the analysis of atmospheric pollutants are described. Two alternative methods of performing the required volume determinations for rotameter calibration are outlined: one uses a water-sealed rotating drum meter (wet test meter), and the other uses a volumetric gasometer (bell prover). Choice of the method depends primarily on the availability of equipment. Although higher accuracy is possible with the gasometer, the accuracies of the methods of atmospheric analysis for which the calibration procedure is intended do not warrant the highest possible accuracy in flow measurement.

49075 **APTIC NO. 71257**

American Society for Testing and Materials, Philadelphia, Pa.

STANDARD METHOD OF TEST FOR RELATIVE DENSITY OF BLACK SMOKE (RINGELMANN METHOD). *Book ASTM Stand., no. 26:694-699, 1974. 6 refs.*

Procedures for determining the relative density of black smoke arising from stacks via the Ringelmann method are described. If a standard Ringelmann smoke chart is used, it is supported on a level with the observer s eye in line with the smoke plume at a distance of about 50 ft from the observer such that the lines on the chart merge into shades of gray. The observer stands at least two stack heights away from the stack and not more than 2500 ft from the stack and determines the Ringelmann number that most nearly corresponds with the shade of smoke being observed by glancing from the smoke plume to the chart. A micro-Ringelmann smoke chart may also be used for such determinations, with the chart being placed on a level with the observer s eye in line with the smoke plume at approximately an arm s length away from the observer. The smoke plume is viewed through a slot in the middle of the chart. If a smoke scope is used, the observer aims the scope so that smoke fills the field of vision through the aperture. The observed smoke plume is compared to the reference images for determination of the Ringelmann number that most nearly corresponds to the shade of smoke observed.

1973

49076 **APTIC NO. 71225**

Corte, G. L., R. S. Thomas, L. Dubois, and J. L. Monkman

CALIBRATION PARAMETERS FOR THE INTEGRATED SILVER METHOD FOR MERCURY IN AIR. II. *Sci. Total Environ., vol. 2:251-258, 1973. 12 refs.*

The analytical parameters for the measurement of mercury in air were investigated for the integrated silver method. The ultimate sensitivity of the method and reproducibility of the standard curve are discussed. The proper storage of the activated silver absorber and the storage of a mercury-air sample on the silver element are described. The collection efficiency for mercury was quantitatively reversible with respect to both capture and release. The collection process on silver was highly specific for mercury. Benzene, for example, was not retained on silver, even though it can give a spurious response when sampled directly by a continuous ultraviolet photometer. Most commonly encountered organic vapors, which give a response at mercury absorption wavelengths, were not retained by the silver element and do not, therefore, interfere with subsequent ultraviolet measurement of the desorbed mercury vapor. For ambient air sampling, the optimum flow rate was 1.5 l/min. This was also a suitable flow rate for desorption and assay. Pure air, as carrier, was satisfactory, since no differences were noticed when comparative measurements were made using inert gases. Instrumental measurement by means of a digital integrator was superior to a recorder output using peak height. Peak area measurement, by integrator, was not affected by the rate of diffusion of the mercury vapor within the sampling system and optical train. (Author summary modified)

49077 **APTIC NO. 70894**

Davies, J. H.

CORRELATION SPECTROSCOPY TECHNIQUES FOR THE REGIONAL AND GLOBAL MEASUREMENTS OF AIR POLLUTION. *Preprint, World Meteorological Organization and World Health Organization, 16p., 1973. 6 refs. (Presented at the World Meteorological Organization and World Health Organization Technical Conference on the Observation of Measurement by Air Atmosperic Pollution, Helsinki, Finland, July 30-Aug. 4, 1973.)*

The correlation spectroscopic method of measuring pollution in the atmosphere is described, and measurements of various pollutants in the atmosphere using this method are discussed. The spectrosopic technique is subject to interferences due to the absorption bands seldom being unique. If a substantial portion of the absorption spectrum of the gas being measured is correlated against a stored replica or mask of that spectrum, significant improvements in detection can be obtained. When natural background radiation is used, such as ultraviolet and visible radiation from the sky, remote monitoring of certain species is possible, such as sulfur dioxide in the ultraviolet and nitrogen dioxide in the blue visible. One of the principle types of measurements that can be made using the remote sensing spectrometric techniques for pollution monitoring is that of vertical burden measurements. Measurements of vertical burdens can be made with correlation remote sensors placed in moving vehicles looking vertically upwards or can be made from aircraft or spacecraft looking vertically downwards using light reflected from the ground. It is possible to combine the vertical burden measurements with wind velocities in order to compute the mass transport of gas moving across tranverse lines. Satellites can be used to monitor global and regional pollution. Several measurement programs using correlation spectroscopy are described including measurements of sulfur dioxide and nitrogen dioxide from aircraft and an SO2/NO2 pollution measuring balloon flight over Chicago. A commercial instrument, Cospec II, to measure SO2 and NO2 simultaneously, and the application of airborne and satellite mounted remote sensors to atmosphere monitoring are discussed.

49078 **APTIC NO. 70414**

Fouche, D. G. and R. K. Chang

INELASTIC LIGHT SCATTERING PROCESSES. *Preprint, 13p., 1973 (?). 3 refs. (Presented at the International Conference on Lidar, 5th, Williamsburg, Va., June 1973.)*

Five different inelastic light scattering processes are discussed, with particular reference being made to the possible use of resonance Raman scattering for remote detection of air pollutants. The light scattering processes examined are: ordinary Raman, resonance Raman, off-resonance fluorescence, resonance fluorescence, and broad fluorescence. The use of resonance to improve the sensitivity of light-scattering techniques for remote detection of air pollutants involves an extra experimental difficulty in using laser excitation close to discrete molecular levels. The scattered intensity is highly dependent on the laser width if it is comparable to or larger than the molecular line width or the molecular Doppler width, both of which are on the order of 10 to the 9 per second for the atmosphere at 20 C. The scattered intensity may also vary considerably if the laser frequency is shifted with respect to the molecular resonances by as little as the molecular line width or the molecular Doppler width. Correct quantitative measurements cannot be made in the field unless the laser used has the same bandwidth and frequency as the laser that was used in the laboratory to determine the scattered intensity per molecule. Another problem associated with resonance is broad fluorescence which will extend over a large spectral range and may interfere with the Raman signals from other pollutants. Measurements of the cross-section of the iodine vapor spike with zero air pressure indicate it to be more than a million times greater than the Raman cross-section of nitrogen. This measurement, coupled with a factor of less than three quenching by the atmosphere, with broad slits, demonstrates that millionsfold increases in the sensitivity of remote detection schemes may be possible by going to resonance. UTHE E E

49079 **APTIC NO. 70839**

Goswamy, P. and K. Basu

AIR POLLUTION MONITORING SYSTEM. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 96-110. (Sept. 11-12.)*

A multi-component air pollution monitoring system is described along with a computerized air pollution data processor. The multi-component system performs continuous field measurements of sulfur dioxide, nitrogen dioxide, nitric oxide, ozone, carbon monoxide, and hydrogen sulfide. The principle of coulometry is used for measurements of SO_2, NO_2, CO, H_2S, and NO; chemiluminescence is employed for O_3 measurements. The coulometric measurements involve bubbling the gas through an electrolyte. A change in the concentration of one of the components of the electrolyte is compensated by an electrochemical reaction with a current that is proportional to the pollutant concentration. Carbon monoxide has no direct effect, and its concentration is measured indirectly by the iodine released when CO is passed through heated iodine pentoxide. Nitric oxide also has no direct effect and is measured as NO_2 after oxidation. Selective filters ensure that each module is specific for the pollutant to be measured. A computerized air pollution monitoring system consisting of a basic system with functions for data acquisition, calculations, logging, dialogue, calibration, alarm and error messages, and testing, as well as other arrangements for meteorological data recording and topographical display is also available. Such a system can predict the onset of serious pollution conditions and automatically issue warnings when predetermined limits are exceeded.

49080 **APTIC NO. 71213**

Kotrappa, P., S. K. Dua, D. P. Bhanti, and P. P. Joshi

HASL CYCLONE AS AN INSTRUMENT FOR MEASURING AEROSOL PARAMETERS FOR NEW LUNG MODEL. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1226-1231, 1974. 15 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

The activity median aerodynamic diameter (AMAD) of aerosols was measured using a cyclone developed by the Health and Safety Laboratory (HASL) of the Atomic Energy Commission. The AMAD is essential to predict the fractional depositions of aerosols in various parts of the respiratory tract. The HASL cyclone does not reflect significant error in the estimation of pulmonary depositions over a size range of 1.5 to 8.0 micron. Measurements made in Trombay Fuel Reprocessing Plant compare well with similar measurements made by other techniques such as Centripeter and Autoradiography. The significance of the measured AMAD is discussed with respect to maximum permissible concentrations (MPC) in air.

49081 **APTIC NO. 70455**

Krause, Fritz R.

TRACE GAS DIFFERENTIAL SPECTROSCOPY. *Preprint, National Aeronautics and Space Administration, Marshall Space Flight Center, Ala., Aero-Astrodynamics Lab., 15p., 1973. 19 refs.*

Multispectral observations have the potential to retrieve the integrated trace gas mass from the difference between two closely spaced channels, one at the crossover wavelength in the wing of the trace gas absorption band, the other at the nearest atmospheric window. Application of this differential spectroscopy to the analysis of data from electromechanical scanners may provide the horizontal coverage and resolution which are needed for monitoring mesoscale and convective scale circulations of fossil fuel combustion products and minor atmospheric trace constituents. (Author abstract)

49082 **APTIC NO. 70833**

Maira, S. K., G. Ram Kumar, N. S. Manthapurwar, and V. Raman

ASSESSMENT OF EMISSIONS FROM STACKS. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 39-45. (Sept. 11-12.)*

Stack sampling procedures and measurements which are useful in the assessment and design of dust control equipment are reviewed. Isokinetic sampling is required for dusts greater than 5 micron in size in order to obtain a representative sample. Other requirements necessary for representative sampling include: drilling the ports at right angles to each other for circular ducts, selecting the number of ports for rectangular ducts based on the cross-sectional area, and locating the sampling ports at least eight times the stack diameter downstream and two times the stack diameter upstream from any flow disturbance. The moisture content of the gas stream must also be known. The rate of gas flow through the duct is obtained by making velocity and temperature measurements, using a pitot tube for the former and thermocouples for the latter measurement. Selection of the trapping device for sampling depends on the temperature, pressure, gas moisture, and physical and chemical properties of the dust- laden gas stream. Samples of dust collected in the trapping medium and connecting lines are dried and weighed for evaluation of the dust concentration. Particle size analysis can be performed by microscopic examination of a dispersion of the dust in water.

49083 **APTIC NO. 70417**

Myers, Richard L.

ELECTRICAL DETECTION OF AIRBORNE PARTICULATES USING SURFACE IONIZATION TECHNIQUES. *Pittsburgh Univ., Pa., Dept. of Physics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 139p. 32 refs.*

A series of investigations were performed to determine the feasibility of developing an electrical technique for counting and sizing airborne particles within a broader size range than existing techniques are capable of achieving. The technique selected was to impinge the particles onto a heated surface capable of causing surface-ionization. Upon striking the surface, each particle is pyrolyzed. Particles capable of becoming surface-ionized leave the surface as atomic or light molecular ions, being either collected onto an electrode or driven into an ion multiplier where they produce a voltage pulse as evidence of having struck the surface. The number of ions released by each particle provides a measure of the size of that particle if the particles are all of similar composition. A further refinement consists of artificially tagging each particle with a specific surface-ionizable substance prior to its striking the heated surface.

49084 **APTIC NO. 70444**

Pruzinec, Jozef and Juraj Tolgyessy

DETERMINATION OF SULFUR DIOXIDE IN THE ATMOSPHERE USING RADIOACTIVE IODINE KRYPTONATE. *(Stanovenie kyslicnika siriciteho v ovzdusi pouzitim radioaktivneho kryptonatu jodu). Text in Slovak. Jaderna Energie, 19(10):345-346, 1973. 10 refs.*

The reagent was prepared by sublimating iodine into krypton, labelling it with 25 mCi krypton (35) per 1 ml Kr. Air (4 ml) containing sulfur dioxide was sucked into the chamber of a sodium iodide (tellurium) scintillation detector through a cuvette containing radioactive kryptonate. The radioactivity of the 35Kr liberated in the reaction of the 35KrI2 with the SO_2 was determined by means of a Coulograph. The SO_2 content was calculated from the liberated 35Kr.

49085 **APTIC NO. 70836**

Sitaraman, V., P. L. K. Sastry, P. B. Rawlani, M. S. Patil, and A. K. Ganguly

A PHOTOCHOPPER FOR REMOTE SENSING OF PARTICULATE LOAD IN THE ATMOSPHERE. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 66-69. 1 ref. (Sept. 11-12.)*

A remote sensing device for the estimation of atmospheric particle loads by light extinction measurements is described. Light from a 200 watt tungsten filament lamp is chopped at a frequency of 22 cycles/sec by means of a cylindrical chopper mounted on a synchronous motor. The receiving system is a normally aligned telescope (magnification 25 power) with a sensitive photovoltaic cell mounted at its eye piece. Light from the source is recognized as alternating current pulses against a background (daylight) direct current signal. The measurements can be performed either during day or evening. Demonstration experiments have established the usefulness of the system for continuous monitoring of atmospheric dust load. A dust load of 100 microgram/cu m gives an extinction coefficient of about 0.12/km. At a distance of 500 m, this represents about a 6% change in intensity due to extinction and is within the detection limit of the system.

49086 **APTIC NO. 71155**

Sulzmann, K. G. P., J. E. L. Lowder, and S. S. Penner

ESTIMATES OF POSSIBLE DETECTION LIMITS FOR COMBUSTION INTERMEDIATES AND PRODUCTS WITH LINE-CENTER ABSORPTION AND DERIVATIVE SPECTROSCOPY USING TUNABLE LASERS. *Combustion Flame, vol. 20:177-191, 1973. 56 refs. (Also: California Univ., San Diego, Dept. of Applied Mechanics and Engineering Sciences, Air Force Office of Scientific Research Contract F44620-68-C-0010, Proj. 9561, 61102F, 681308, Rept. AFOSR-TR-73-1086, 17p., 1973.)*

NTIS, DDC: AD 762696

Some theoretical estimates were made for the possible limits of detectability in line-center absorption and derivative spectroscopy using tunable lasers on transparent gas systems with Lorentzian or Doppler line shape. Detection limits achievable with laser absorption techniques are three to four orders of magnitude smaller than those obtainable with correlation spectroscopy. Changes in transmitted laser signals of 10 to the - 5th power to 10 to the - 6th power should be measurable with a signal-to-noise ratio of ten at an amplification bandwith of 100,000 Hz. Summary tables are presented of detection limits for a number of chemical species. The feasibility of applying line-center and derivative laser spectroscopy to the simultaneous measurement of reactants, reaction intermediates, and product species in selected combustion systems is discussed. The combustion products and reaction intermediates which can be measured include carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, hydrogen sulfide, sulfur dixide, ammonia, and water. Applications to selected combustion systems ar discussed including premixed ammonia air flame at atmospheric pressure over a flat burner with a 2 cm diameter, the exhaust gases from an SST operating in the stratosphere or from a high-altitude rocket booster, and satellite observations of mean pollutant levels through a scale height equal to 8 times 10 to the 5th power cm. (Author abstract modified)

49087 **APTIC NO. 71251**

Ward, Gray, K. M. Cushing, R. D. McPeters, and A. E. S. Green

ATMOSPHERIC AEROSOL INDEX OF REFRACTION AND SIZE-ALTITUDE DISTRIBUTION FROM BISTATIC LASER SCATTERING AND SOLAR AUREOLE MEASUREMENTS. *Appl. Opt., 12(11):2585-2592, Nov. 1973. 29 refs.*

Tropospheric aerosol properties were studied by remote means using laser scattering and solar aureole photography. A well collimated polarized laser beam was used to make both intensity and polarization measurements from 8-172 degrees in broad daylight at ranges of 100-1200 m. Turbidity measurements and solar aureole scattering data in the region from 2-12 degrees were used to fix features of the size altitude distribution that are insensitive to particle shape. The data were analyzed with a regularized power law oversize distribution, assuming single Mie scattering corrected for Rayleigh scattering. Typical values obtained for particle radius, total number of particles per unit volume, and the complex index of refraction of undisturbed aerosols were 0.05 micron, 10,000/cu cm, and 1.50 + 0.05. The laser and aureole techniques were in quantitative agreement under good vertical mixing conditions. (Author abstract modified)

49088 **APTIC NO. 70411**

Warda, R. D. and R. K. Buhr

A METHOD FOR SAMPLING CUPOLA EMISSIONS. *AFS (Amer. Foundrymens Soc.) Trans., vol. 81:24-31, 1973. 2 refs.*

A stack sampling method, used extensively for the sampling of flue gases from combustion processes, was adapted for use in the sampling of cupola emissions. Modifications made the sampling trains more rugged, portable, and responsive to the rapidly changing conditions encountered in a cupola stack. This equipment was field tested over a 12-week period during which detailed measurements were made on emissions produced by six iron foundry cupolas. All tests conducted in the cupola stack were at the maximum height above the charge door that was commensurate with access limitations or downstream flow disturbances. The test section of the stack was subdivided into three or more equal, concentric areas, each of which was sampled at four points by two mutually perpendicular sampling probes. Each sampling point in the test cross section was sampled for a constant period of time equal to or exceeding the charge cycle time. Each test consisted of simultaneous measurements of temperature, velocity, and composition of the stack gas and of continuous, isokinetic collection of particulates. The reliablility and practicality of the method used was assessed not only by statistical analysis of the data collected, but also by material balance calculations. Variance tests showed that sampling errors are insignificant when compared to the inherent variability of cupola operation. The extent of this variability is such that repetitive sampling is mandatory if statistically significant results are to be obtained. The application of material balance equations, either to simultaneous measurements or to the average of measurements obtained over a statistically significant testing period, indicated that the parameters measured accurately described the cupola operation. (Author abstract)

49089 **APTIC NO. 70856**

Andros Inc., Berkeley, Calif.

DEVELOPMENT OF TRACE GAS DETECTION INSTRUMENTATION (FINAL REPORT). *National Aeronautics and Space Administration Contract NAS2-6358, Rept. CR 137514, ARFR-24, 99p., April 1973. 1 ref.*

NTIS: N74-27889

The development of a heterodyne-type trace gas analyzer is described. The principle encompasses the density modulation of a reference and a sample gas in two chambers sequentially spaced along an optical pathlength. The density modulation is accomplished at different frequencies in the chambers, and means are provided to observe the absorption of a beam of infrared radiation which passes sequentially through both chambers to a radiation detector. The construction of a breadboard unit established the sensitivity and selectivity of the method for the gases carbon monoxide, carbon dioxide, and nitrous oxide. Further development led to the construction of a prototype three-gas analyzer capable of measuring the gases CO, CO2, and methane. A technical paper on heterodyne gas analysis and efforts to develop miniature Helmholtz resonators are presented in separate appendices.

1972

49090 **APTIC NO. 70419**

Chaney, Lucian W.

HIGH RESOLUTION SPECTROSCOPIC MEASUREMENTS OF CARBON DIOXIDE AND CARBON MONOXIDE (TECHNICAL REPORT). *Michigan Univ., Ann Arbor, High Altitude Engineering Lab., National Aeronautics and Space Administration Contract NSR 23-005-376, Office of Research Administration Proj. 036350, NASA CR-130139, 036350-3-T, 81p., July 1972. 3 refs.*

NTIS: N74-27591

A 1.83 m Fastie-Ebert vacuum scanning infrared spectrometer for high resolution measurements of carbon dioxide and carbon monoxide is described as part of a long-term effort to develop meteorologically significant satellite radiation measurements. The theoretical resolution of the spectrometer is 0.027/cm at a 16 micron blaze angle, and the measured resolution is 0.05/cm. The data scan rate is 220 sec/wave number, exept for 2.3 micron data (110 sec/wave number). The instrument utilizes an integrating voltmeter to optimize the available integration time. Data obtained in the 15 micron and 4.3 micron band of carbon dioxide and the 4.6 micron and 2.3 micron bands of carbon monoxide are provided along with examples of typical spectra. The data are currently being analyzed, and the results will be reported in the future.

49091 **APTIC NO. 70862**

Schulte, D. A., D. J. Larsen, R. W. Hornung, and J. V. Crable

REPORT ON ANALYTICAL METHODS USED IN A COKE OVEN EFFLUENT STUDY. *Preprint, American Chemcial Society, 25p., 1972. 14 refs. (Presented at the American Chemical Society, National Meeting, 164th, New York, Aug. 28-Sept. 1, 1972.)*

In a coke oven study, selected chemical analyses of airborne particulates, vapors, and metals in the emission from five coke ovens were done. Eight sampling procedures and seven analytical techniqes were used to analyze samples collected for the study. The benzene soluble fraction of coal tar pitch volatiles, upon which the present standard is based, did not correlate well with any of the tested analytical methods for polynuclear aromatics. This lack of correlation requires that epidemiological studies be conducted to determine if the polynuclear aromatic hydrocarbons will be a good index of the hazards of exposure to coal tar pitch volatiles. It is desirable to find a new analytical method for assessing coal tar pitch exposures because of the obvious drawbacks of the benzene soluble method. As its name implies, the method is nonspecific, analyzing for all compounds soluble in benzene. There are also problems involved in the procedure itself: the weights of benzene soluble material may be erroneous due to a disintegration of the filter and loss of particulates during handling and extraction or due to a change in the water content of the filter between the tare and fianl weight after extraction. A method is needed which is specific for certain compounds or classes of compounds. At present, no single method can be found. More work must be done to determine exactly which components of coke oven emissions are hazardous and at what concentrations they affect the worker adversely. Once this is known, the Federal standard must be re-evaluated, and suitable analytical methods selected. Gas chromatographic and high-pressure liquid chromatographic methods hold promise, however, because of their specificity and ease of operation.

1971

49092 **APTIC NO. 70489**

Dubois, L., A. Zdrojewski, T. Teichman, and J. L. Monkman

THE MEASUREMENT OF SULPHATE IN AIR. *Environmental Protection Service, Ottawa (Ontario), Chemistry Div., Air Pollution Control Directorate Rept. 71-6, 20p., 1971. 8 refs. (Also: J. Environ. Anal. Chem., March 1971.)*

According to some scientists, measurements of sulfate in the air can be influenced by the sampling time. According to experiments by Lee and Wagman, the higher concentrations found for short sampling times are due to the oxidation of sulfur dioxide to sulfate at the filter surface due to the catalytic action of the glass fiber sheet. If the sulfate concentration can be four to ten times greater for shorter sampling times, it is very important to know the true concentration to establish air quality standards for sulfate. Since most of the sulfate data available is based on 24-hour samples, it is conceivable that this data would be used for setting air quality standards. If it were later found that the air quality standards were lower than the actual normal sulfate in air values, this could be embarrassing for the legislators. The possibility of setting standards related to inaccurate background data should be guarded against with all pollutants. Therefore, the experiments of Lee and Wagman were repeated, but the air sampling anomaly was not observed for sulfate. Certain weaknesses of the currently used turbidimetric methods for sulfate were exposed, however. In order to obtain valid results is appears necessary to carry out the filtration of the extract through millipore instead of ordinary filter paper to eliminate the small glass fibers and the tiny particles of dust which are able to go through the filter. Furthermore, it is wise to read the solution before and after the addition of barium salt in order to correct for the interference due to the color of the solution. It is also necessary to prepare the standard curve in a medium similar to that of the samples. These observations explain the anomaly in sulfate sampling. (Author abstract modified)

49093 **APTIC NO. 70195**

Petrick, Dieter

MEASUREMENT OF CONCENTRATION OF COMUSTILE GASES AND VAPOURS WITH AUTOMATIC ZERO AND SENSITIVITY ADJUSTMENT. *(Geraet zur Messung der Konzentration brennbarer Gase und Daempfe). Text in German. (Auergesellschaft GmbH, erlin (Germany)) W. Ger. Pat. Appl. 1,965,804. 4p., July 8, 1971. 3 refs. (10 claims).*

The device comprises bridge circuit consisting of a detector and compensating resistors and resistors to form the input to the operational amplifier. Spirals are exposed in a probe to a burning gas, one of which is made so that a catalytic combustion of the gas takes place on it, making it hotter than the other spiral with the result that there is a voltage output from the bridge which depends on the gas concentration. This is amplified by amplifiers the output of which is fed to an indicator. For automatic zero adjustment a pulse is fed into the input which sets a binary counter to zero and switches off all transistors. A flip-flop circuit opens a gate and the voltage of the comparator decreases, in steps, to zero. Thereafter, the comparator opens a gate and a counter switches on the transistors. A similar network operates the automatic sensitivity adjustment.

1966

49094 **APTIC NO. 71151**

Konosu, Hisao and Yoichiro Mashiko

INDUSTRIAL ANALYTICAL SPECTROSCOPY. PART 12. DETERMINATION OF ORGANIC SUBSTANCE VAPOR-AIR MIXTURE BY A NONDISPERSIVE ULTRAVIOLET GAS ANALYZER. *(Hibunsangata shigaisen gasu bunsekikei ni yoru yuki kogyo yakuhinjoki no teiryoho). Text in Japanese. Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), 69(8):1449-1454, 1966.*

To meet the requirements for a quick and simple method of measuring explosive mixed gases for environmental safety, a simple non-dispersive ultraviolet gas analyzer model was constructed, and in previous experiments, sulfur dioxide, benzene, carbon disulfide, acetone, methyl ethyl ketone, and trichloroethylene were satisfactorily measured. But levels less than the maximum permissible concentrations of benzene and carbon disulfide could not be measured. Part of the apparatus was redesigned, and in this experiment methyl formate, ethyl formate, methyl acetate, ethyl acetate, ethyl bromide, diethylamine, and n-butylamine were used. In this method the liquid material is poured into the gas cell warmed by warm water and gasified for measurements. Therefore materials with boiling points above 150 C would be a little more time consuming. The apparatus is basically the same as in previous reports, but the sensitivity was adjusted by changing the resistance of the measurement meter in the circuit and the current for the meter was doubled to increase the sensitivity. The two reflectors were also enlarged. The analyzer measures a large range covering from 6 ppm of diethylamine to 6 vol% of methyl formate. The variation coefficients for 137 ppm ethyl formate and 2.74 vol% permeation measurement were 0.023 and 0.016% respectively. The measurement time was within 1 min and the operation was simple. Material that has ultraviolet absorption in the test material, (e.g., sulfur dioxide, hydrogen sulfide, nitrogen dioxide, halogen, mercury, ozone) and compounds with double bonds and aromatic hydrocarbons must be eliminated before measurement since they affect the measurements.

AIR QUALITY MEASUREMENTS

1975

49095 **APTIC NO. 71432**

Herlan, Albert

HYDROCARBONS IN DUST SEDIMENTS - A MASS SPECTROMETRIC STUDY. *(Kohlenwasserstoffe in Sedimentationsstaeuben - eine massenspektrometrische Untersuchung). Text in German. Staub, Reinhaltung Luft, 35(2):45-50, Feb. 1975. 19 refs.*

The hydrocarbon content of urban dusts was determined by high- resolution mass spectrometry at low-ionizing voltage. Between 200 and 300 cyclic and polycyclic compounds (z less than or equal to -6) characterized by the formula C_nH_{2n+z} and having molecular weights from 92 to 368 were detected in the benzene extracts. The distribution of all hydrocarbons including the more saturated hydrocarbons (z greater than -6) was determined by total ion current.

1974

49096 **APTIC NO. 71362**

Ando, Asahiro, Kenichiro Terai, and Yoshikazu Nasu

AIR POLLUTION BY FLUORIDE IN TOMAKOMAI, HOKKAIDO PART 2. *(Hokkaido Tomakomai chiku ni okeru fukkabutsu osen ni tsuite, dai 2-ho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):543, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 391.)*

The atmospheric fluorine level in the Tomakomai area was analyzed for contents of gaseous fluoride compounds, and water soluble and water insoluble fluorine particulates using a dry separatory collection technique. The sample was collected at two locations near a fluorine pollution source. The average composition of atmospheric fluorine compounds was 10% gaseous fluoride compounds, 60-70% water soluble, and 20-30% water insoluble fluorine particulates. The average total fluorine concentration in the atmosphere was about 0.8 micrograms/cu m. The conventional fluorine autoanalyzer detected only 10% of total fluorine in air, because the teflon filter inside the analyzer excluded fluorine particulate.

49097 **APTIC NO. 71440**

Asai, Kazuhiro and Takashi Igarashi

DETERMINATION OF OXIDANTS, USING CO2 LASER. *(CO2 reza o mochiita okishidanto sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):220, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 77.)*

The use of carbon dioxide laser to determine atmospheric ozone concentration is described. In a half-hour period during a photochemical smog alert ozone concentration of about 0.2 ppm was measured by laser near Tachikawa, Japan.

49098 **APTIC NO. 70817**

Briehl, Daniel

IN SITU MEASUREMENT OF PARTICULATE NUMBER DENSITY AND SIZE DISTRIBUTION FROM AN AIRCRAFT. *NASA Tech. Memo., 1974:1-12, 1974. 6 refs. (Presented at the American Meteorological Society and the American Institute of Aeronautics and Astronautics, 2nd International Conference on Environmental Impact of Aerospace Operation in the High Atmosphere, San Diego, Calif., July 8-10, 1974, Paper NASA TM X-71577.)*

In situ measurements of particulate number density and size distribution were made with two different commercial particulate measuring instruments aboard an aircraft at altitudes of 5-12 km. A condensation nuclei monitor was used to measure particles larger than 0.003 micron in diameter; a specially designed pressurization system used with the counter permitted sample feeding into the monitor at cabin altitude pressure. A near-forward light scattering counter was used to measure the number and size distribution of particles from 0.5 to 5 micron and greater in diameter. Considerable variation in number density was encountered for both classes of particles at altitudes between 5 and 12 km. Concentrations of light scattering particles ranged from 250,000/cu m for the smallest size range to about 3/cu m in the largest size range, with the size distribution in clean air typifying a Junge power law distribution with an exponent of 3-3.5. Condensation nuclei concentrations ranged from the limit of detectability to 1100 particles/cu cm. Very large numbers of particles, especially in the larger size range, were detected by the slope of the size distribution when the aircraft flew through clouds.

49099 **APTIC NO. 70398**

Cote, William A., Willard A. Wade, III, and John E. Yocum

A STUDY OF INDOOR AIR QUALITY (FINAL REPORT). *Research Corporation of New England, Wethersfield, Conn., Environmental Protection Agency Contract 68-02-0745, Proj. 32247, Program Element 1AAOO5, 1HA326, Rept. EPA-650/4-74-042, ROAP 22 ACB, 293p., Sept. 1974. 3 refs.*

NTIS: PB 238556/AS

The contribution of gas stoves to indoor pollutant levels was determined by measuring concentrations of nitrogen dioxide, nitric oxide, and carbon monoxide. In laboratory studies, gas stoves emitted significant quantities of pollutants in these ranges: NO 90-130 micrograms/kcal; NO2 50-80 micrograms/kcal; and CO 400-1000 micrograms/kcal. Four private residences were monitored, and there were significant differences in the indoor patterns of pollutants within each of the houses. Except for CO in one house, concentrations of pollutants were higher inside than outside, and kitchen concentrations were always the highest. Indoor concentrations of NO2 in the kitchen at most of the houses were at levels which would exceed the annual average air quality standard of 100 micrograms/cu m if projected over 1 yr. Indoor CO concentrations during the winter at two houses approached the 8-hour average air quality standard of 10,000 micrograms/cu m. Indoor contaminant sources other than stoves are smoking, house cleaning activities, cooking, and use of aerosol products. (Author summary modified)

49100 APTIC NO. 71272

Cross, Frank L., Jr.

FLUORIDE EMISSIONS FROM PHOSPHATE PROCESSING PLANTS. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 159-165. 4 refs. (March 18-19.)*

Results from field monitoring activities in the vicinity of a phosphate fertilizer plant are reported. Plant dumps some 2000 tons/day of gypsum waste into a settling pond from which fluorides are released into the atmosphere. Maximum fluoride concentrations of 32,000 micrograms were observed at a distance of 1500 ft from the pond, with the concentration dropping sharply to 3000 micrograms at a distance of 2700 ft. Analyses of citrus leaves within 0.2 mi of the plant revealed levels up to 550 ppm in old leaves and up to 150 ppm in young leaves. Levels of 75 ppm were found in young leaves 0.5 mi from the phosphate plant; this concentration appears useful as an indicator of air pollution capable of reducing citrus yield. Measurements at the surface of the pond demonstrated fluoride emissions of up to 0.16 lb/acre/day. At least 26 lb of fluoride/day were emitted from the 160-acre gypsum pond.

49101 APTIC NO. 71080

Fujie, Kimiko

SUSPENDED PARTICULATES IN OSAKA CITY. *(Osaka ni okeru fuyu biryushi no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):255, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 116.)*

A high volume air sampler with a glass fiber filter is used to analyze the particulate matter at seven sampling stations in Osaka city. Continuous analyses are made for 1970 through 1973 for airborne particulate weight concentration, sulfate salts, nitrate salts, metals, and benzo(a)pyrene contents. The content of individual chemicals in airborne particulates decreased from 1970 to 1973 except for nitrate salts which increased since 1972. The average nitrate content in 1973 was 5.19 micrograms/cu m. The decrease in other chemicals from 1970 to 1973 was 67% for airborne particulate weight concentration (the average concentration in 1973 was 175 micrograms/cu m), 59% for sulfate salts (15.8 micrograms/cu m in 1973), and 48% for benzo(a)pyrene (0.00744 micrograms/cu m in 1973). The correlation factors between individual particulates are also obtained at seven sampling stations. The correlation factor between total particulate matter and sulfate salts ranged between 0.236 and 0.918, 0.463 to 0.929 for total particulate matter and benzo(a)pyrene, and 0.442 to 0.863 for total particulate matter and nitrate salts.

49102 APTIC NO. 71011

Fujitani, Y. and Y. Ito

SPECTRAL ANALYSIS OF POLLUTANT CONCENTRATIONS. *(Taiki osen nodo no supekutoru kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):272, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 130.)*

The correlations of nitric oxide and nitrogen dioxide with carbon monoxide and sulfur dioxide levels are made by the analysis of phase shift spectra which are calculated based on the CO, SO2, NO, and NO2 analytical data collected at the national main road 19 of Nagoya city. The phase shift spectra are plotted as frequency versus phase shift in radians. The phase shift of NO for CO was smaller than that for SO2 throughout the year indicating that the NO pollution was mainly caused by automobile exhaust. The effect of home heating was observed in the NO phase shift for SO2 in winter, which was smaller than its summer shift. The phase shift of NO2 for CO was observed at 12 hr to 36 hr which strongly suggested the photooxidation of NO to NO2. No apparent NO2 phase shift was observed for CO in a low frequency region and for SO2 in a high frequency region.

49103 APTIC NO. 71366

Fujitani, Yoshiyasu, Tokuichi Yokoyama, and Tsuyoshi Kubota

CORRELATION BETWEEN VISIBILITY AND DUST IN NAGOYA DISTRICT. *(Nagoya chiku ni okeru shido to dasuto tono sokan). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):530, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 378.)*

The visibility in Nagoya was determined by photographic technique from the top of a building. Several objects were selected, and visibility was determined by the objects in the photograph. The obtained visibility was compared with the available air pollution data. Levels of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides, and dust were examined and correlation of visibility with dust level was found. The visibility on a sunny day with dust level below 0.05 mg/cu m was very high, and mountains surrounding the city could be observed; however, when the dust concentration was higher than 0.2 mg/cu m, the visibility was very poor (less than 2 km). The visibility was approximately 5 km when the dust level was 0.07 mg/cu m. A preliminary experiment showed that similar visibility was obtained by both photograph and the human eye.

49104 APTIC NO. 71357

Hirai, Kunio, Mitsuo Tokuda, and Keiko Ikeda

AIR POLLUTION RESEARCH BY FILTER PAPER METHOD DURING THE PAST FIVE YEARS, 1969-1973, IN YAMASHINA AREA, KYOTO. *(Yamashina chiku ni okeru roshiho ni yoru 5 nenkan no taiki osen chosa ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2): 517, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 364.)*

Atmospheric sulfur oxides and nitrogen oxides were measured in the Yamashina area for five years by the standard filter paper technique. The area was divided into 20 sections and measurements were reported from 22 stations. The highest SOx level observed was 1.01 mg/day/100 cu cm which occurred in January 1969. All stations reported a decreasing SOx trend with years, reflecting the effect of SOx control laws. The overall average of the stations was 0.245 and 0.118 mg/day/100 cu cm in 1969 and 1973, respectively. The highest NOx level observed was 0.318 mg/day/100 cu cm in December 1972. The NOx at most of the stations showed similar levels throughout the five year observation period. The average NOx levels in 1969 and 1973 were 0.039 and 0.041 mg/day/100 cu cm.

49105 APTIC NO. 71347

Ikeda, Kenichi, Yosuke Kishi, and Kazuo Murakami

STUDIES ON AIR POLLUTION IN KAWANOE AND MISHIMA, EHIME PREFECTURE. *(Ehimeken Kawanoe-Mishima shi no taiki osen no kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):518, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 19.)*

The sulfur oxides and nitrogen dioxide levels in the Kawanoe and Mishima areas were measured by an alkaline filter paper method. Several paper mills are located in the area and they are mainly responsible for the air pollution. The SOx level during the summer was the highest of the year, and the sulfur trioxide near paper mills was 0.94 mg/day/100 cu cm. The fall season showed the lowest level of SOx. The area east of the mills showed higher SOx than other surrounding areas, reflecting the sea wind in this direction. The areal sulfur trioxide distribution obtained was similar to the distribution of non-blow soming of fragrant olives. Wherever higher SO3 was observed, a higher percentage of non-blossoming of fragrant olives was found; for example, more than 40% of fragrant olives did not blossom in an area in which more than 0.4 mg/day/100 cu cm of SO3 was recorded.

49106 **APTIC NO. 70973**

Inoue, R. and Y. Watanabe

STATISTICAL PROPERTIES OF SULFUR OXIDES CONCENTRATIONS AT CONTINUOUS MONITORING STATIONS IN JAPAN, PART II. *(Jido sokutei-ki niyoru iosankabutsu nodo sokuteichi no tokeiteki seishitsu ni tsuite, II). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):268, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 126.)*

Statistical treatment of continuous sulfur dioxide analytical data taken at Sapporo and Muroran is discussed. Muroran is a large industrial area, while Sapporo does not have much industry. Hourly, daily, and monthly variations of SO2 level are obtained. Large hourly variation was noted in the Sapporo monitoring station; 1181.1 and 248.3 for 1970 and 1973 data, respectively. The hourly variation in the Muroran Station was 118.8 and 93.9 for 1972 and 1973 respectively. The monthly variation in Muroran was 3.2 and 5.1 for 1972 and 1973 respectively, but the monthly variation in Sapporo was still much larger than that of Muroran; 295.2 and 59.1 for 1970 and 1973 respectively. The yearly average SO2 level in 1973 was 26.9 ppb for Sapporo and 20 ppb for Muroran. The simple geometric monthly averages in 1973 for the Sapporo and Muroran stations were 25.4 ppb and 19.4 ppb respectively; however, these values became much closer to the yearly averages when the logarithmic normal distribution was assumed for the SO2 data and recalculated. The calculated values were 26.1 ppb and 19.7 ppb.

49107 **APTIC NO. 70974**

Inoue, R. and Y. Watanabe

STATISTICAL PROPERTIES OF SULFUR OXIDES CONCENTRATIONS AT CONTINUOUS MONITORING STATIONS IN JAPAN, PART III. *(Jido sokutei- ki niyoru iosankabutsu nodo sokuteichi no tokeiteki seishitsu nitsuite, III). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):269, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 127.)*

Discussion of statistical treatment of continuous sulfur dioxide analytical data taken at Sapporo and Muroran is continued. A logarithmic normal distribution is assumed for the continuous SO2 concentration data for one year. By introducing an arbitrary time scale, the mathematical treatment is made to predict the SO2 levels in daily, weekly, and monthly averages, and each calculated value is compared with those values obtained by a simple geometric average of the actual data for the time period. The results for 1973 data are as follows (statistically calculated values are shown in parenthesis) for the daily, weekly, and monthly averages 24.80 ppb (24.90), 25.33 ppb (25.77), and 25.42 ppb (26.19) for the Sapporo station, and 18.53 ppb (18.70), 19.22 ppb (19.18), and 19.44 ppb (19.41) for the Muroran station. The difference between the calculated and observed value was generally within one ppb, indicating that the statistical treatment can be made to predict the SO2 level for an arbitrary time scale using the geometric yearly averaged SO2 level if a logarithmic normal distribution is assumed.

49108 **APTIC NO. 71439**

Kaizu, Y., M. Murata, H. Tamura, M. Kimoto, H. Hirobe, T. Matsui, M. Kawakami, N. Miyamura, and K. Hashizume

AIR POLLUTION STUDY BY LASER RADAR. *(Reza reda ni yoru taiki osen kansoku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):221, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 79.)*

Rooftop observations were made with laser radar to determine pollutant concentration distributions in a vertical direction. Higher correlation was found between scattering intensities at 90 degrees, and the airborne particulate concentrations, determined by light scattering on samples taken at the same time laser radar observations were taken.

49109 **APTIC NO. 71101**

Kato, Tatsuo and Yasuki Kano

TOTAL ANALYSIS OF AIR POLLUTANTS. NO. 27. *(Taiki osen no zenbunseki. Dai-27-ho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):217, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 74.)*

As one of the indexes for global scale air pollution, the carbon dioxide concentration in and around Tokyo was measured. For simple and expedient analysis, air sample was collected in pyrex a glass tube and placed in a 2-milliliter gas sampler for gas chromatographic measurement. The diurnal variation in urban area (Yokohama) showed minimum CO2 concentration in daytime and maximum at night, though it varied with meteorological conditions. The average CO2 concentration was 392 ppm and average diurnal variation was 49 ppm. The CO2 distribution in Kanto plain (Asakusa to Shinfujiwara) showed no definite trend, however, slightly higher CO2 concentration was observed near Tokyo. At 12 points at sea between Tokyo and Hachijo island, samples were collected and analyzed. Between Hachijo and Tateyama, CO2 concentrations were 372-376 ppm, showing little variation. However, they increased to 377 ppm off the coast of Urawa, 379 ppm off Yokohama, and 389 ppm off Shinagawa. These values are unexpectedly higher, since the natural CO2 level is about 300 ppm.

49110 **APTIC NO. 70808**

Kneip, Theodore J., Merril Eisenbud, Michael Kleinman, and David Berrstein

STUDIES OF TRACE SUBSTANCES IN AN URBAN ATMOSPHERE. *New York Univ. Medical Center, New York, National Institute of Environmental Health Sciences Grant ES00260, 25p., 1974 (?). 6 refs.*

Findings are summarized from studies of New York City air designed to determine the following: temporal and seasonal patterns in the variations of trace metal and ion concentrations for total suspended particulates and settled dust; the effects of meteorological parameters on total suspended particulates and trace element concentrations; sources (such as domestic heating, power generation, ocean spray, and engine exhausts) of trace metals or ions; and the relation of aerosol trace element compositions to human tissue burdens caused by exposure to the atmosphere. Associations exist between lead, vanadium, copper, sodium, and potassium and some 40-65% of the total aerosol. The aerosol associated with lead (and possibly the automobile) accounts for 20-30% of the total, while that associated with vanadium (and probably oil-burning sources) accounts for 10-14% of the total. Vanadium, Pb, and total suspended particulates show maxima and minima which can be related to source terms independent of the variable meteorological effects. The normalized total suspended particulates and V results clearly reflect space heating and closely correlate mathematically to degree day data. Dust fall studies show that copper is found on relatively large particles (1.8 micron mass median diameter), while nickel and V have mass median diameters of less than 1 micron. Human tissue analyses indicate that Pb, Ni, and chromium show elevated levels in the combined Hilar and pulmonary lymph nodes as compared to the lung. This distribution, which indicates a phagocytic clearance mechanism, and a clearance half-time of 39 days for lead as computed from the study data are in qualitative agreement with the fact that Pb in New York aerosol is less than 20% soluble in water.

49111 **APTIC NO. 71356**

Koike, Shigeyuki, Akihiro Sakamoto, Susumu Sakata, Takeshi Katsuyama, Takeshi Nikaido

ON THE SUSPENDED PARTICULATES CONCENTRATION, NO. 5, VISIBILITY AND COMPONENTS. *(Fuyu funjin no sokutei kekka ni tsuite, dai 5-ho, shido to seibun no kankei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):532, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 380.)*

The relationship between visibility and suspended particles was studied in Wakayama Prefecture using a high-volume air sampler. The components studied were sulfate, nitrate, and ammonium ions, which comprise 20 to 40% of total water soluble particulates. The visibility during the summer was better than that in winter. The median values of visibility during the summer were 11.4, 11.6, and 10.4 km for 1971, 1972, and 1973, respectively, and those during the winter were 15.0, 14.0, and 18.8 km. The correlation factors of visibility with several ions were obtained.

49112 **APTIC NO. 71349**

Kusunose, Kaoru, Seiji Takeuchi, Hiroaki Murase, Hayao Kawamura, Tsunehito Kawada, and Sojiro Yanagi

HEAVY METAL COMPONENTS IN DEPOSIT DUST. *(Kochi-shi ni okeru koka baijin chu jukinzoku seibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):537, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 385.)*

Sedimented dust was collected by a deposit gauge and analyzed for manganese, iron, zinc, copper, and calcium by atomic absorption spectrometry in Kochi, which has several iron alloy manufacturers and cement manufacturers. Samples were collected at ten different locations in the city to represent various kinds of areal conditions. The average metal contents in sedimented dust were 0.91%, 2.16%, 0.175%, and 0.35% for Mn, Fe, Zn, and Cu respectively, and these values did not deviate greatly between polluted and non-polluted areas (except for manganese). Two locations had higher manganese content in dust and ranged from 2.06% to 5.77%. The correlation factors of manganese with iron, zinc, and calcium in polluted area were relatively high, 0.63, 0.75, and 0.50, respectively; however, correlation between other pair of metals was not found.

49113 **APTIC NO. 71171**

Lovelock, J. E.

FLUOROCARBONS IN THE ENVIRONMENT. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 455-463, Dec. 11-12, 1974. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

Concentrations of halocarbons were measured in the global environment. Concentrations of fluorotrichloromethane and ozone measured in 1973 in southwest Ireland and southern England are illustrated. Measurements made of halocarbons over the Atlantic Ocean in Oct. 1973 show these concentrations in parts per trillion: dichlorodifluoromethane 115.2; fluorotrichloromethane 88.6; trichloroethane 75.1; trichloromethane 18.9; carbon tetrachloride 137.6; tetrachlorethylene 21.2; and methyl iodide 2.1.

49114 **APTIC NO. 71446**

Mamuro, T., T. Matsunami, Y. Matsuda, and A. Mizohata

RELATION BETWEEN METAL CONTENT AND AIRBORNE PARTICLE SIZE (II). *(Taiki fuyujin no ryudo betsu kinzoku sosei (II)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):238, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 97.)*

The distribution of metals in airborne particles with respect to particle size was determined by irradiating dust samples with neutrons and analyzing the resultant radiation. Dust samples were collected with the Andersen sampler for 84 hr. The elements present were magnesium, aluminum, chlorine, calcium, titanium, vanadium, and manganese. Metals found in greatest amounts in larger dust particle sizes of 3.3-4.7 micron were Mg, Al, Ca, Ti, Mn. Chlorine and vanadium were found mostly in smaller-sized particles.

49115 **APTIC NO. 71413**

Mizoguchi, I. and Y. Sato

ANALYSIS OF SUSPENDED PARTICULATE MATTER BY EDS. *(Taikichu fuyu funjin no EDS ni yoru bunseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):232, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 91.)*

A combination of scanning electron microscope and nondispersive X-ray analysis was used to determine elements present in submicroparticles of air samples. Peaks were observed for sodium, magnesium, aluminum, silicon, sulfur, chlorine, potassium, calcium, iron, nickel, and zinc. Silicon, aluminum, and iron were present in the largest amounts but sulfur was present most often. Sodium and magnesium were present in only a few samples. Particles greater than 1 micron in size usually showed more than three types of elemental energy distributions, and only a few particles contained only one element. Even where scanning electron microscope images were unclear (x10,000), EDS analysis was possible.

49116 **APTIC NO. 71348**

Nakazawa, Y., I. Hirosawa, and M. Maruyama

AIR POLLUTION BY FLUORIDE OF OMACHI DISTRICT, REPORT 2. *(Nagano-ken Omachi chiiki no ikeru fukkabutsu ni yoru taiki osen ni tsuite, dai 2-ho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):542, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 390.)*

The content of fluorine in rainfall and soil was measured in the Omachi area, Nagano Prefecture, where a fluorine pollution source exists. The fluorine concentration in soil increased linearly with the increase in soil particle size. The monthly transition of fluorine level was also studied, and the fluorine level in the winter was higher than that in the summer.

49117 **APTIC NO. 70965**

Ohta, T., M. Morita, and I. Mizoguchi

THE DISTRIBUTION OF CHLORINATED ALIPHATIC HYDROCARBONS IN METROPOLITAN AIR. *(Tonai taiki-chu no enso-kei yuki yozai). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):212, Nov. 1974. 1 ref. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 69.)*

Atmospheric concentrations of chloroform, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, and tetrachloroethylene were measured selectively by simplified gas chromatographic analysis. Air samples were collected using a syringe in four areas with several locations in each area totaling 26 sites in Tokyo during May, June, July and Aug. 1974. Analysis was done by electron capture detector gas chromatograph. Average concentrations of each area were in the range of 7-267 ppb for CHCl3, 0.4-3.0 ppb for CH3CCl3, 0.6-16.5 ppb for CCl4, 0.8-17 ppb for C2HCl3, and 0.7-8.1 ppb for C2Cl4. The concentration and variation in concentration of CHCl3 were particularly high compared to other pollutants.

49118 **APTIC NO. 70321**

Sato, Shizuo

ATMOSPHERIC NITROGEN OXIDES CONCENTRATION IN TOMEI HIGHWAY. *(Kosoku doro shuhen chiiki ni okeru taiki-chu chisso sankabutsu nodo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):496, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Nov. 6-8, 1974, Chiba, Japan, Paper 342.)*

The atmospheric nitrogen oxides concentration in the vicinity of Tomei highway was measured at six locations from Jan. 29 to Jan. 31, 1974. The 1-hour values of nitric oxide and nitrogen dioxide were measured by manual analysis (Saltzman method) and automatic analyzer (chemiluminescence and Saltzman method). The NO_x concentration was greatly influenced by wind velocity. The highest concentrations measured were 28.1 pphm for NO and 7.3 pphm for NO_2. The daily average concentrations of NO_x at six locations were 1.7-14.9 pphm for Jan. 29, 2.7-18.1 pphm for Jan. 30 and 3.5-18.0 for Jan. 31. The NO_x concentration decreased with the increase in distance from the highway; however, its effect was evident even at 500 m. The ratio of NO_2 in NO_x ($NO + NO_2$) increased with the increase in distance from the highway.

49119 **APTIC NO. 70964**

Sato, Yasuhito, Kyniyoshi Makino, Isao Mizoguchi, and Hiroshi Yagyu

RELATIONSHIP OF HYDROCARBONS AND CHLORINATED HYDROCARBONS TO OTHER AIR POLLUTANTS. *(Taikichu tanka suiso oyobi ensokei yuki yozai to hoka no osenbutsu tono sokan ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc Air Pollution), 9(2):213, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 70.)*

The correlation between hydrocarbons and other atmospheric pollutants was investigated. Air samples collected in a Tokyo suburb were analyzed by a flame ionization gas chromatograph and a mass spectrometer. The chromatogram of one sample showed 32 peaks, among which three were unidentified. To investigate the correlation among HC, correlation coefficients were obtained. Results were analyzed by the group arrangement method, by which the peaks were classified into two groups, one consisting of aliphatic and aromatic HC and the other of halogenated HC. The correlation coefficient of representative pollutants to other atmospheric variables was obtained. Ozone, oxidant, total HC, nitrogen dioxide, and suspended particulates showed negative correlation to ultraviolet radiation; halogenated HC such as dichloroethane showed no correlation to other pollutants; and aromatic HC such as benzene and toluene showed a high correlation to suspended particulates.

49120 **APTIC NO. 70859**

Sissons, N. V.

RESULTS OF ROCKET SONDE MEASUREMENTS OF OZONE FROM WOOMERA (31 DEGREES S) AND THE ESTIMATION OF STRATOSPHERIC NITROGEN DIOXIDE CONCENTRATIONS. *Australian Defence Scientific Service Weapons Research Establishment, Adelaide (Australia), Weapons Research Establishment, WRE-TN-1089, 70p., Jan. 1974. 56 refs.*

NTIS: N74-25893

The results of four rocket radiosonde measurements of the ozone distribution above Woomera, Australia (136 degrees east and 31 degrees south) are described and compared with ozone profiles from other locations. Substantial temporal and spatial ozone variability above 22 km was observed in excess of measurement error. This ozone variability can be accounted for on the basis of odd nitrogen oxide chemistry using a one-dimensional numerical model. The peak in the nitrogen dioxide mixing ratio occurred at approximately 35 km for all cases studied. Concentrations of nitrogen dioxide required to sustain the experimental ozone profiles agreed well with recent experimental data for stratospheric NO_2. A list of possible photochemical reactions involving ozone is given in an appendix.

49121 **APTIC NO. 71445**

Takahashi, T. and K. Honma

RESEARCH OF AIR POLLUTION BY THE THIN METAL FILM METHOD. *(Kinzoku hakumakuho ni yoru taiki osen chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):240, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 100.)*

Air Pollution within a radius of 60-70 km from Tokyo was investigated by using thin films of iron and copper to capture airborne particles, and determining the extent of corrosion of the films with an optical microscope. Metal-corrosive particles are dispersed over almost all of Tokyo, Chiba, and Kanagawa.

49122 **APTIC NO. 70997**

Toyoguchi, Tsuneo and Kazutoshi Kisaichi

TIME SERIES ANALYSIS OF AIR QUALITY DATA. *(Taiki osen nodo no jikeiretsu kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):271, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 129.)*

A time series analysis of the sulfur oxides level is done in Sapporo which is a typical city with urban pollution caused by home heating in winter. A specific 24-hour cycle of SO_x was observed. Data on these cycles were extrapolated statistically using the Fourier series, and 12-, 8-, 6-, and 4-hour cycles were confirmed. No cycle longer than 24 hr was observed, and the curve obtained by the Fourier series expansion exponentially decayed with time.

49123 **APTIC NO. 71353**

Toyoguchi, Tsuneo

VARIATION OF SO_2 CONCENTRATION BY EMISSION CONTROL IN SAPPORO. *(Sapporo-shi no nenryo kisei gono taiki osen nodo no doko). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution) 9(2):520, Nov. 1974. (Presented at the National Air Pollution Conference, 15th, Chiba, Japan. Nov. 6-8, 1974. Paper 367.)*

Fuel control measures for home heating were imposed in Sapporo in both 1971 and 1972. A study was made to ascertain the effectiveness of the controls by comparing the atmospheric sulfur oxides levels in 1970, 1971, and 1972 at four sampling locations. The analytical data did not show a consistent trend to SO_x level with years, because some stations reported a decrease in SO_x from 1970 to 1971 and an increase from 1971 to 1972, while other stations showed a steady decrease with years. The average SO_x levels found were 4.23, 3.19, and 3.50 pphm for 1970, 1971, and 1972 respectively. Increases of atmospheric temperature were noted during winter with years; -2.7 C, - 2.2 C, and - 1.3 C, suggesting an increase in the number of home heating units.

49124 **APTIC NO. 70317**

Yabuki, K., Y. Suzuki, and S. Kawagishi

ON AIR POLLUTANTS IN AND AROUND ROADS. *(Doro shuhen ni okeru taiki osenshitsu no dotai ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):490, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Nov. 6-8, 1974, Chiba, Japan, Paper 336.)*

The increase in traffic volume is one of the contributing factors of air pollution. The pollution at roadside of the Osaka beltway, Rt. 310, Rt. 21, a littoral industrial highway and some suburban roads was surveyed. The concentrations of oxidant, nitrogen dioxide, and sulfur dioxide were measured using a mobile measuring station while cruising or at rest during the period of May to Dec. 1973 and July to Aug. 1974. The results are analyzed with data obtained on Aug. 10 and 14, 1974 as examples. The variations in pollutant concentrations were evaluated in relation to the traffic volume, and a definite correlation was found. The NO2 concentration varied from 0.03 ppm at a suburban road to 0.1 ppm at the beltway, while ozone concentration decreased from 0.15 ppm at the suburban road to 0.01 ppm at the beltway. The ozone concentration decreased exponentially with the increase in traffic volume, which was attributable to the reaction of O3 and nitric oxide [illegible] automotive exhaust gas producing NO2.

49125 **APTIC NO. 69036**

Ibaraki Prefectural Government (Japan), Air Quality Division

WHITE PAPER ON THE ENVIRONMENT, 1973. *(Kankyu hakusho). Text in Japanese. 322p., March 1974.*

In 1972, the rate of passing the new environmental standard at the 10 monitoring stations of the Kashima area was between 17.2% and 100%; there were only two cases of more than 0.04 ppm concentration continuing for two or more days. In other areas of the Prefecture, the environmental sulfur oxide concentration by the lead dioxide measurement method ranged between 0.09 mg/day/100 sq cm, and 0.45 mg/day/100 sq cm. The suspended particulates annual average in the Hitachi area was 0.02-0.03 mg, and in the Kashima area, 0.02-0.06 mg according to digital dust counter measurements. The settling particle concentrations were decreasing; in the Hitachi area, the total average was 6.9 tons/sq km/mo, with one area reaching an extremely high level of 16.90 tons/sq km/mo. ut the figures were 24 and 25 tons in 1970 and 1971. In the Kashima area, the 1972 average was 9.99 tons, with the maximum of 27 tons; the 1973 average between April and October was 10.07 tons with the maximum of 27.20 tons at the same monitoring station. Although the averages are declining, six monitoring locations out of 16 exceeded 10 tons in 1972. Seventy-two plants are closely watched for toxic gas emissions; most of them emit chlorine gases or lead. Monitoring stations for nitrogen oxides increased from five to 12 between 1972 and 1973. Many areas still fail to pass the NOx standard; the monthly averages range between 0.007 and 0.026 ppm. All 10 monitoring locations excluding the 11th reached oxidant maximum hourly levels of 0.15 ppm, and seven monitoring stations reached 0.2 ppm.

49126 **APTIC NO. 70500**

Sapporo District Meteorological Observatory (Japan), Tomakomai Weather Station

THE STATE OF AIR POLLUTION IN TOMAKOMAI. *(Tomakomai ni okeru taiki osen no genjo). Text in Japanese. Sapporo Kanki Kishodai Gijutsu Jiho (Sapporo Dist. Meteorol. Observ. Tech. ull.), no. 82:27-40, March 1974.*

The paper and lumber industries in Tomakomai city developed rapidly as a new industrial area after the completion of new harbor in 1963. The air pollution measurements initiated in 1963 are now monitored at the Pollution Control Center established in 1973. The data obtained at 26 measuring points in the city were compiled and analyzed. The yearly average settling particulate was 11.2 tons/k sq m/mo in 1972, and the data compiled since 1963 showed a decreasing trend. Within a 1.5 km radius of Ohji Paper Mill, the sulfur dioxide concentration was as high as 0.5 mg/100 cu cm/day. The relationships between the SO2 concentration and meteorological factors were analyzed. The average fluorine gas concentration was 81.2 micrograms/100 cu cm/mo, however, the concentration reached as high as 150-270 micrograms/100 cu cm/mo in the vicinity of an aluminum refinery and fertilizer plant.

49127 **APTIC NO. 71102**

Bureau of Environment, Hyogo Prefecture (Japan)

PRESENT STATUS ON AND COUNTERMEASURE AGAINST ENVIRONMENTAL POLLUTION. *(Kogai no genjo to taisaku). Text in Japanese. 23p., Aug. 1974.*

Survey data on environmental pollution in Hyogo Prefecture are compiled. As for air pollution, sulfur oxides and nitrogen oxides concentrations were compared with those of the previous 4 yr and evaluated in reference to the new environmental standard issued in May 1973. In many areas, SOx and NOx were above the environmental standard. The water pollution in terms of biochemical oxygen demand was further deteriorated in many rivers and bays compared to those in 1972. The noise and vibration along a major highway and industrial complex were surveyed, and showed an increasing trend. As for malodor, the new control standard was issued in April 1973, and applied to chemical, leather processing, bone-meal, sewage treatment, nightsoil treatment, incineration plants and the liverstock industry. On specific pollution due to automobiles, SOx, carbon monoxide, nitrogen dioxide, and lead concentrations were measured and evaluated in reference to environmental standards. Data on pollution-related complaints were compiled. The number of complaints in seven major categories were 3977, which was a 2.1% increase from the previous year.

1973

49128 **APTIC NO. 70452**

Cavanagh, L. A. and J. H. Smith

ATMOSPHERIC PHOTOCHEMICAL SMOG MEASUREMENTS OVER SAN FRANCISCO BAY (FINAL REPORT). *Stanford Research Inst., Menlo Park, Calif., Environmental Protection Agency Contract 68-02-1009, Coordinating Research Council Contract CAOA-12-72, California Air Resources Board Contract 2-021, SRI Proj. 2092 and 2098, 127p., Aug. 1973.*

NTIS: PB 237425

A mobile laboratory aboard a houseboat and an airborne helicopter laboratory were used to measure the composition and concentration of smog constituents in a moving air parcel over the San Francisco Bay during autumn of 1972. Data from four selected days were analyzed to determine the correlation of the ratio of nitric oxide and ozone concentrations divided by nitrogen dioxide concentration to solar intensity and NO concentration. The correlation to NO concentration was high (0.87), while that to solar intensity was low (minus 0.09). The concentrations of NO over the Bay appeared to be inhomogeneously distributed. The NO concentration varied by factors as high as 6 (6-40 pphm) over distances of 5 km or less. The study substantiated that a mobile laboratory can follow marked air parcels if meteorological conditions are favorable. Although virtually no photochemical activity was present during the experimental program, the measurement data obtained can provide useful data for simulation modeling at concentration levels equivalent to air quality standards. (Author abstract modified)

49129 **APTIC NO. 70824**

Rote, D. M., I. T. Wang, L. E. Wangen, R. W. Hecht, R. R. Cirillo, and J. Pratapas

AIRPORT VICINITY AIR POLLUTION STUDY (FINAL REPORT). *Atomic Energy Commission, Ill., Argonne National Lab., Dept. of Transportation Contract I. A. DOT FA71WAI-223, Rept. FAA-RD-73-113, 306p., Dec. 1973. 42 refs.*

NTIS, DDC: AD-780049

The development of an Airport Vicinity Air Pollution model (AVAP) that can be used to determine the impact of an existing or planned airport on the air quality in its vicinity is described. Simulation of airport and surrounding activities and their corresponding pollutant emission rates was performed in conjunction with the development of a short-term air pollution dispersion model comprising point-, area-, and line-source submodels. Air quality and emission data were gathered from O Hare International Airport, a predominantly commercial airport, and Orange County Airport in Los Angeles, a predominantly general aviation airport. Calculations of pollutant concentrations (hydrocarbons, carbon monoxide, nitrogen oxides, and particulates) were performed on an hourly basis at both airports using locally measured meteorological variables and computed emissions. Comparison of the computations with observations indicated that NOx was the most suitable species for model testing at O Hare because of a favorable signal-to-noise ratio. At the Orange County airport, NOx were substantially underpredicted because of low signal-to-noise ratios. To the extent that the NOx data at O Hare were valid, the comparisons between calculations and observations showed that the model is a reliable predictor of NOx concentrations in the airport vicinity. The least satisfactory of all predictions was that for particulates since particulate emission factors were the most uncertain of all pollutant species studied.

49130 **APTIC NO. 70392**

California Air Resources Board, El Monte

LABORATORY ANALYSES OF ATMOSPHERIC HYDROCARBONS-CALIFORNIA SOUTH COAST AIR BASIN (LOS ANGELES AIR QUALITY CONTROL REGION) AUGUST-NOVEMBER 1973 (FINAL REPORT). *Environmental Protection Agency Contract 68-02-0788, Task 10, Program Element 1AAOO8, EPA-650/4-74-052, ROAP 21AKC, 1024p., Jan. 1974.*

Laboratory analyses of atmospheric hydrocarbons sampled in the Los Angeles air quality control region from Aug.-Nov. 1973 are tabulated. All samples were analyzed with gas chromatographs for carbon 1-C 6 hydrocarbons. A few selected samples were also analyzed for hydrocarbons through n-nonane. A description of the methods used precedes the 1015 pages of raw data. (Author abstract modified)

1970

49131 **APTIC NO. 70401**

Picard, H., W. Prove, Y. van Bavinchove-Ossola, and W. van Rijckeghem

STATISTICAL ANALYSIS OF AIR POLLUTION MEASUREMENTS BY THE BELGIAN MONITORING NETWORK IN 1969. *(Een statistische analyse van de metingen van de luchtverontreininging door de Belgische meetstations in 1969). Text in Dutch. Natuurwet. Tijdschr., no. 52:199-221, 1970. 5 refs.*

A statistical analysis of sulfur dioxide concentration measurement data obtained by means of 124 sampling stations of the Belgium air pollution monitoring network in 1969 is presented. The analysis is based on the median values with respect to Joosting s classification and on the frequency of concentration readings in excess of 350 micrograms/cu m. An optimum classification comprising five categories combines statistical criteria with medical norms. In the first category rated as sound, 50% of all readings are below the 90 micrograms/cu m limit, and 99% below the 350 micrograms/cu m limit. In the second category, rated as acceptable, 50% and 97% of all readings are below the 130 and 350 micrograms/cu m limits, respectively. The third class comprises that in which 50% of the values are below the 170 micrograms/cu m limit, with 90% below the 350 micrograms/cu m limit. In the fourth or hazardous category, 50% of all readings are lower than 210 micrograms/cu m, and 82% are lower than the 350 micrograms/cu m limit. In a fifth category, represented by one sampling station, a median value of 247 micrograms/cu m was established, and 70% of all readings are below the 350 micrograms/cu m limit. Nearly half of all sampling stations indicated unacceptable SO2 levels. The SO2 concentrations measured in the winter were significantly higher than those measured during the summer period.

ATMOSPHERIC INTERACTION

1975

49132 **APTIC NO. 70998**

Cunnold, D., F. Alyea, N. Phillips, and R. Prinn

A THREE-DIMENSIONAL DYNAMICAL-CHEMICAL MODEL OF ATMOSPHERIC OZONE. *J. Atmospheric Sci., 32(1):170-194, Jan. 1975. 57 refs.*

A 3-year integration of a global 3-dimensional dynamic photochemical model of atmospheric ozone was used to predict ozone behavior. Distributions of nitrogen dioxide and odd hydrogen deduced by other investigators were used to incorporate the chemical effects of these species into the model. Good agreement with observation was obtained for stratospheric motion patterns, meridional circulations, ozone density as a function of height and latitude, eddy transports of ozone, surface destruction of ozone, and correlations of ozone with other variables. The annual cycle of columnar ozone in high latitudes was predicted but at a smaller amplitude than that observed. Vertical transport of ozone downward from the main generation level at 30 km was accomplished primarily by small-scale eddy diffusion between 20 and 30 km and again near the ground. Large-scale vertical transport dominated in between. The model predicted a secondary maximum in ozone mixing ratio at 45 km in the winter polar-night zone somewhat toward the equator. The latter feature, observed from satellite measurements also, was caused by the temperature-dependence of reaction rates in the Chapman scheme. The principal deficiency of the model was an underprediction of the spring ozone concentration in high latitudes in the lower stratosphere. (Author abstract modified)

49133 **APTIC NO. 71084**

Hall, Charles A. S.

LOOK WHAT S HAPPENING TO OUR EARTH. *Bull. At. Sci., 1975:11-21, March 1975. 57 refs.*

Interactions between the biosphere and the industriosphere are reviewed, with particular emphasis on the global effects of fossil fuel combustion. Increasing concentrations of carbon dioxide (from fossil fuel combustion) are estimated at 0.3-0.4%/yr and are capable of causing rises in atmospheric temperature and photosynthetic activity of the biosphere. Increases in nitrogen oxides and sulfur oxides from the combustion of fossil fuels are responsible in part increasing rain acidity. Dust emissions from the burning of fossil fuels compensate for the effects of carbon dioxide, with the net effect being a temperature decline since the year 1940. Insolation may be decreasing in the northern hemisphere by as much as 0.2-0.4%/yr. Anthropogenic particulates are also affecting cloud formation and perhaps rainfall distribution.

49134 **APTIC NO. 70980**

Payrissat, Maurice and Siegfried Beilke

LABORATORY MEASUREMENTS OF THE UPTAKE OF SULPHUR DIOXIDE BY DIFFERENT SOILS. *Atmos. Environ., 9(2):211-217, Feb. 1975. 13 refs.*

The influence of some soil parameters on the uptake of sulfur dioxide by different European soils was investigated in a closed chamber. An increase of soil pH from 4.5-7.6 corresponded to a 10-fold increase in soil resistance to SO2 transfer under constant transfer conditions at a relative humidity of 40-50%. At constant pH the soil resistance decreased with increasing relative humidity. The soil resistance to SO2 uptake was most sensitive to relative humidity at low soil pH. The influence of prior SO2 contamination on further SO2 uptake by the soils was small compared to that of pH and relative humidity. (Author abstract modified)

49135 **APTIC NO. 70981**

Ragland, Kenneth W. and Robin L. Dennis

POINT SOURCE ATMOSPHERIC DIFFUSION MODEL WITH VARIABLE WIND AND DIFFUSIVITY PROFILES. *Atmos. Environ., 9(2):175-189, Feb. 1975. 19 refs.*

A point source atmospheric diffusion model with variable wind and diffusivity profiles is presented. The flow field is specified by inputing the height of the mixing layer, the wind speed at the top of the mixing layer, the net heat flux to the air, and the surface roughness. A comparison of predicted pollutant concentrations with those predicted by a Gaussian plume model which assumes constant wind and dispersion coefficients with respect to the vertical direction reveals good agreement between maximum ground level concentrations for neutral atmospheric stability. However, significant differences exist between the three-dimensional plume distribution and the Gaussian model. The surface roughness appears to significantly influence the concentration distribution. The product of pollutant concentration times wind speed does not depend on wind speed for neutral stability but does for stable and unstable conditions. (Author abstract modified)

49136 **APTIC NO. 71502**

Raynor, Gilbert S., Eugene C. Ogden, and Janet V. Hayes

SPATIAL VARIABILITY IN AIRBORNE POLLEN CONCENTRATIONS. *J. Allergy Clin. Immunol., 55(3):195-202, March 1975. 3 refs.*

The relationship between airborne pollen concentrations and distance was investigated over a 2-year period in urban and rural locations distant from major pollen sources during both tree and ragweed pollen seasons. Simultaneous samples were taken at a height of 1.5 m during 5 to 20-minute periods in 171 tests with sets of eight rotoslide samplers spaced from 1 to 486 m apart in straight lines. The average coefficient of variation is 0.21, the maximum over the mean 1.39, and the minimum over the mean 0.69. No relationship was found with experimental conditions. Samples taken at the minimum separation distance had a mean difference of 18%. Differences between pairs of samples increased with distance in 10 of 13 groups. Airborne pollens are not always well mixed in the lower atmosphere. A sample becomes less representative with increasing distance from the sampling location. (Author abstract modified)

1974

49137 **APTIC NO. 71486**

Bacci, P., G. Elisei, and A. Longhetto

LIDAR MEASUREMENT OF PLUME RISE AND DISPERSION AT OSTIGLIA POWER STATION. *Atmos. Environ., 8(11):1177-1186, Nov. 1974. 13 refs.*

Lidar measurements of plume rise from the stack of an oil-fired power station were compared to various plume rise formulae. The best agreement was found with Briggs laws under neutral conditions, stable windy conditions, and stable calm conditions. Calculations of maximum ground-level concentrations were also performed using lidar-measured plume cross wind dimensions at maximum ground concentration distances of 1500 to 12,000 m. Extrapolations of lidar-measured maximum ground level concentrations to distances where sulfur dioxide monitoring devices were situated resulted in agreement with ground-level SO2 measurements to within one order of magnitude or less. Lidar sounding of plumes emitted from high stacks provides the experimental data necessary to select the plume rise formula giving the best fit in real situations for different meteorological conditions.

49138 **APTIC NO. 71166**

Cicerone, Ralph J., Richard S. Stolarski, and Stacy Walters

STRATOSPHERIC OZONE DESTRUCTION BY MAN-MADE CHLOROFLUOROMETHANES. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 273-275, Dec. 11-12, 1974. 18 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The effects of chlorofluoromethanes produced by man on the concentrations of stratospheric ozone in future decades are discussed. The chlorofluoromethanes have no natural source or sink in the troposphere. Their lifetimes are controlled by diffusion into the stratosphere where they are photodisssociated by ultraviolet light. Current CFxCly usage levels and trends can lead to chlorine-catalyzed O3 destruction rates exceeding all natural sinks of stratospheric O3 by the early 1980s. If emissions were curtailed now, the resultant O3 destruction would maximize around 1990 and would remain significant for several decades. The sum of the concentrations of Cl, ClO, and hydrogen chloride will increase significantly in the stratosphere, but not in the troposphere.

49139 **APTIC NO. 71162**

Crutzen, Paul

A REVIEW OF UPPER ATMOSPHERIC PHOTOCHEMISTRY. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 234-246, Dec. 11-12, 1974. 84 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The photochemical processes which determine the distribution of important minor constituents in the stratosphere and mesosphere are reviewed. Nitrogen oxides catalyze and destroy ozone, reducing total O3 in the atmosphere considerably. The O3 reductions which could result from the operation of large fleets of supersonic aircraft due to exhaust emissions of nitrogen oxides into the stratosphere are estimated. Ozone is important for the climate of the upper atmosphere. Its presence in the troposphere is important for reactions occurring within the nitrogen and carbon cycles of the troposphere.

49140 **APTIC NO. 70649**

Delany, A. C., J. P. Shedlovsky, and W. H. Pollock

STRATOSPHERIC AEROSOL: THE CONTRIUTION FROM THE TROPOSPHERE. *J. Geophys. Res., 79(36):5646-5650, Dec. 20, 1974. 18 refs.*

Aerosol samples collected during stratospheric flights over the midcontinental United States were analyzed by neutron activation for sodium, chlorine, potassium, manganese, bromine, and silicon compounds. The flights were made in autumn and in spring along the 39 deg north parallel between 109 and 87 deg west at altitudes of 11.0, 13.4, 15.8, 18.2, and 20 km. The long sampling paths served to integrate variations in aerosol mixing ratio and composition, thus providing a good representation of mean aerosol composition. Plotting of the mass mixing ratios of the elements against altitude revealed the presence of earth surface-generated aerosol particulates in the stratosphere. The element ratios of Na/Si and Na/K were consistent with this tropospheric aerosol component, having the same composition as the upper tropospheric background aerosol. Determination of the relative contribution of continental and oceanic components by considering the ratio of the nonvolatizable elements, Si, Na, and K, showed that sea salt accounts for no more than a few percent of the tropospheric contribution. Stratospheric chlorine and bromine concentrations were in excess by two- and 200-fold, respectively, over values consistent with the marine component of the tropospheric contribution. Thus, chlorine and bromine were capable of entering the stratosphere in a gaseous form and reacting to give aerosol particulates.

49141 **APTIC NO. 71088**

Flemming, G.

CALCULATION OF THE DUST DISPERSION BY A LONG-TERM MODEL. *(Berechnung der Staubausbreitung nach einem Langfristmodell). Text in German. Z. Meteorol., 24(3-8):150-154, 1974. 11 refs.*

Calculation of dust immission is more difficult than that of gas propagation because the theory of dust propagation is rather complex and includes the falling speed of dust as an additional parameter and the required input parameters in many cases cannot be furnished by the manufacturers. The model presented in this paper supplies monthly values of dust sedimentation covering the wind directions according to their frequencies. Dust immission is very much affected by the grain size.

49142 **APTIC NO. 70322**

Fujitani, F., T. Yokoyama, and F. Matsunari

ROADSIDE DIFFUSION OF NO. *(NO no endo kakusan). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):497, Nov. 1974. (Presented at the 15th National Air Pollution Research Conference, Nov. 6-8, 1974, Chiba, Japan, Paper 343.)*

The diffusion of nitric oxide at roadside was measured by the batch type Saltzman method at two locations in Nagoya. The peak of horizontal NO concentration distribution was found at the leeward edge of the road in the case of wind direction at a right angle to road, and at a median strip in the case of wind direction at a 22.5 degree angle to raod. The result of the former was in good agreement with the concentration distribution calculated from Fick s diffusion equation, which showed no peak at the median strip. The diffusion coefficient was estimated to be about 2-4 sq m/sec. The NO concentration distribution was also measured at three major roads. The horizontal distribution showed high NO concentration only at the edge of road. The measurement of vertical distribution indicated that NO concentration at 0.5 m altitude was less than that at 1.5 m in all cases, and decreased generally with altitude higher than 2 m.

49143 **APTIC NO. 71351**

Fujitani, Y., A. Yokoyama, and N. Suga

INVESTIGATION OF METEOROLOGICAL FACTORS AFFECT SO2 POLLUTION IN NAGOYA DISTRICT. *(Nagoya chiku ni okeru SO2 osendo ni taisuru kiatsu haichi no eikyo, tokibun). Text in Japanese. Taiki Osen Kenkyu (J. Japan, Soc. Air Pollution), 9(2):522, Nov. 1974. (Presented at the National Air Pollution Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 370.)*

The atmospheric sulfur dioxide in the Nagoya area during winter was studied in relation to the distribution of atmospheric pressure which is classified into three categories; rain front, winter, and others. When the distribution was of a rain front type, the chance of occurrence of daily SO2 level above the average (0.047 ppm) was 92%. It was 23% for the winter type and 50% for the third type. For the chance of occurrence of the hourly SO2 level above the average (0.089 ppm), the rain front type gave 86%, the winter type gave 18%, and the third type also gave 18%.

49144 **APTIC NO. 71390**

Fujitani, Yoshiyasu, Masahiro Suzuki, and Fumio Matsunari

INVESTIGATION OF ONE-DIMENSIONAL DIFFUSION MODEL. *(Ichiji-gen kakusan modere). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):292, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov 6-8, 1974, Paper 147.)*

The carbon monoxide level on a small stree is calculated and compared with the observed level to test a one-dimensional diffusion model. The subject street is located 5 m off a busy highway, and the calculation is made based on the traffic at both roads. Only vertical diffusion of CO is considered; therefore, the CO on the highway is transferred to the sampling spot by wind. Calculation and measurement of CO are made for 10 hr, and both results are plotted as CO concentration against time. Both plots gave a similar CO transition with time; however, the calculated values for 8 to 10 am were lower than the observed levels. The maximum CO level in the morning was 7 ppm and 9 ppm for calculated and observed values respectively, which occurred around 9 am.

49145 **APTIC NO. 70338**

Ghazi, Anver

SATELLITE NIMUS RECORDS OZONE DECREASE IN THE ATMOSPHERE. *(Satellit Nimbus registriert Ozonabnahme in der Atmosphaere). Text in German. Umschau Wiss. Tech., 74(21):679-680, 1974. 4 refs.*

The global ozone budget is calculated for the first time using satellite data. Nimbus IV measurements show a net loss of atmospheric ozone in the tropics in 1971. In April of 1971 the global ozone mass of 3.38 times ten to the ninth power tons was about 3.5% smaller than in April of 1970. This variation of the ozone mass might be due to meteorological or photochemical processes. The resulting increase in the ultraviolet radiation might have had an impact on the tropical biosphere. 1 70339 NONE TANIYAMA T WATANAE T TAIKI OSEN KENKYU J JAPAN SOC AIR POLLUTION 1974 JAPANESE EFFECTS-PLANTS, LIVEST FLD YEAR 1974 CROPS PLANT DAMAGE JAPAN DIFFUSION CHLORINE 70339 Taniyama, T. and T. Watanabe PLANT AND CROP DAMAGES Y CHLORINE EMITTED Y AN ACCIDENT FROM COMINATE IN YOKKAICHI AREA. (Konbinaato jiko ni yotte ryushutsu shita ensogasu ni yoru nosakumotsu oyobi shokubutsu higai). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):371, Nov. 1974. ASTRACT About 10-12 tons of liquid chlorine issued from a factory in a Yokkaichi combinate by an accident on April 30, 1974 at 3:20 in the afternoon. According to the survey of plant and crop damage by chlorine, the species damaged were 34 crops, 21 flowers, 17 trees, and eight weeds. The wind at that time was southeast, 5-6 m/sec. The crops which were 12 km from the source showed injuries, and the width of the damage covered about 2-3 km. The chlorine gas flowed on the paddy field and moved along rivers to damage rice seedlings and flowering French beans.

49146 **APTIC NO. 71167**

Green, A. E. S., T. Sawada, and E. P. Shettle

THE MIDDLE ULTRAVIOLET REACHING THE GROUND. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 290-298, Dec. 11-12, 1974. 26 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

A semi-empirical analytical formula is presented for calculating the direct, diffuse, and global solar middle-ultraviolet radiation (280-340 nm) reaching the ground. The formula accommodates variations in wavelength, solar angle, ozone thickness, aerosol thickness, ground albedo, ground elevation, and cloudiness. Analytic representations of biological action spectra are presented for use in calculations of effective dose at any time of day. A basis for estimating approximate changes in middle-ultraviolet radiation levels reaching the ground caused by anthropogenic changes in the intervening atmosphere is provided. (Author abstract modified)

49147 **APTIC NO. 70944**

Heines, T. S. and L. K. Peters

THE EFFECT OF GROUND LEVEL ABSORPTION ON THE DISPERSION OF POLLUTANTS IN THE AT-

MOSPHERE. Atmos. Environ., 8(11):1143-1153. Nov. 1974. 10 refs.

The emission of an air pollutant species from a point or line source is analyzed for a case in which the pollutant may be absorbed (or desorbed) at ground level. Solution of a mass conservation equation leads to expressions which describe the concentrations downstream from the emission source, with the ground level concentrations being presented in the form of dimensionless plots. Typical numerical values for the parameters in the equations are used to show that the concentration profiles over water in the vicinity of the emission source are appreciably affected only for very soluble gases such as sulfur dioxide, ammonia, and hydrogen chloride. While oceans may serve as important repositories for less soluble gases such as carbon monoxide and carbon dioxide; the ground level concentrations of such gases over water near an emission source are not likely to be affected very much by the rate of absorption or desorption. (Author abstract modified)

49148 **APTIC NO. 71001**

Hino, Mikio and Teruo Tajima

PREDICTION OF POLLUTANT CONCENTRATION BY PHASE-REGRESSION ANALYSIS. *(Shuki kaiki moderu ni yoru taiki osen yosoku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):276, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 132.)*

In order to predict the air pollution level, meteorological factors are considered. An anticipated pollutant level is calculated from a regression matrix considering the time function of several variables such as wind velocity, atmospheric stability, and pollutant emission rates. This concept is called a phase-regression model. The sulfur dioxide level is calculated by the phase-regression model and compared with results observed in the Mizushima industrial area. The calculation predicted a general trend of SO2 levels for specific time periods in the area. To simplify the calculations, correlation factors between variables are recommended for use.

49149 **APTIC NO. 71178**

Hogstrom, Ulf

TRANSPORT AND DISPERSAL OF ODORS. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.) New York, Academic Press, 1974, p. 163-198, 13 refs.*

A mathematical analysis of the transport and dispersion of odors is presented along with an odor dispersion model that has absolute odor frequencies as the output. The model predicts the occurrence of instantaneous concentrations of odors equal to or above an absolute odor threshold level. Field tests indicate that up to several kilometers distance from a stationary industrial source, predicted odor frequencies do not significantly deviate from observed frequencies. At large distances the observed odor frequencies are larger than those calculated by a factor of two or three. The reason for the discrepancy is not clear. The odor dispersion model nevertheless offers an effective planning tool since it can be used to assess the effect on the enviromment of different engineering efforts to reduce the odor strength of stack gases.

49150 **APTIC NO. 71113**

Ikeda, Arimitsu, C. Nakajima, and M. Umeki

APPLICATION OF PHOTOCHEMICAL REACTION MODEL TO FLOWING POLLUTED AIR MASS. *(Ryudo suru osen kikai e no kokagaku hannoshiki no tekiyo). Text in Japanese. Tenki (Weather), 21(10):517-525, Oct. 1974. 7 refs.*

The propagation mechanism of summer-time photochemical smog was analyzed by examining concentrations of nitric oxide, nitrogen dioxide, and oxidants measured in the Keihin district. Large- scale air-pollution in the Keihin district was, as a result, classified into three types, all of which corresponded to flowing patterns of air currents. It was estimated that high concentrations of air pollution occur on days when southwest wind blows into the Kyoto basin in the daytime, bringing pollutants formed in Osaka to the southern part of Kyoto. A photochemical reaction model for flowing air mass was developed around the hypothesis that dilution of a single polluted air mass expands vertically by diffusion while the air mass moves. This photochemical reaction model explains fluctuation in oxidant concentration. When the amount of sunshine is reduced to zero, measured oxidant concentration is relatively high, whereas the photochemical reaction model predicts a very low value. This discrepancy is attributed to the following items: some unknown substances beside ozone are present in oxidants, data on NO are inaccurate, ozone is present in higher concentration in the upper air than on the ground in the daytime and the reverse is true of NO, NO2, and hydrocarbons.

49151 **APTIC NO. 70747**

Israel, G. W.

DEPOSITION VELOCITY OF GASEOUS FLUORIDES ON ALFALFA. *Atmos. Environ., 8(12):1329-1330, Dec. 1974. 6 refs.*

Fumigation of alfalfa and orchard grass with constant hydrogen fluoride levels for more than 16 days yielded a deposition velocity of 16 mm/sec as compared with an estimated deposition velocity for field crops of alfalfa and orchard grass of 31 + or - 16 mm/sec. The estimated average fluoride accumulation coefficient for field crops was about twice that derived from the fumigation studies, though the reason for the discrepancy was not established. The deposition velocity values for alfalfa were about 3-6 times higher than published deposition velocity values for sulfur dioxide on grass. This difference may be partially due to the relatively large leaf surface area of alfalfa per unit area of ground and the vertical spacing of the leaves. Assuming that atmospheric fluorides are admitted by ghe plant mainly through the leaves and that the effective fluoride absorption area is 5 sq m of leaf surface per sq m of ground surface, the alfalfa deposition velocity is similar to SO2 deposition velocities reported for grassland.

49152 **APTIC NO. 71350**

Ito, S., T. Saito, M. Ito, and H. Oota

SO2 CONCENTRATION AROUND IRON AND STEEL WORKS. *(Seitetsusho shuhen ni okeru SO2 nodo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):525, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 373.)*

The atmospheric sulfur dioxide level in Soga, Chiba Prefecture, was measured by the conductivity method and coulometry. The latter technique gave real time SO2 analysis; however, it gave a lower analytical value than that obtained by the conductivity method. Many steel companies and power stations are located at the west side of the town, and a SW wind always caused higher SO2 in the town. More than 50 pphm SO2 was observed with a strong WSW to W wind (6.0 m/sec) at 3:05 pm. High level SO2 was also noted in a larger area with stronger winds, indicating that a stronger wind limited the pollutant dispersion. Coulometry can instantaneously locate the factory most responsible for the areal SO2.

49153 **APTIC NO. 71099**

Kakuta, Michio, Shinichi Suga, and Takashi Hayashi

DIFFERENCE WITH HEIGHT OF ATMOSPHERIC DIFFUSION PARAMETER IN COASTAL SITE. *(Engan chiiki ni okeru kakusan parameta no takasa ni yoru sa). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):284, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 138.)*

The vertical wind velocity at altitude 20 m and 90 m was measured for 9 mo from August 1973 to evaluate the atmospheric diffusion of gaseous radioactive materials. The measurements were made using an observatory tower of the Japan Nuclear Power Laboratory located 600 m from the Oarai beach. The standard deviations of wind velocity in August at 90 m and 20 m were 0.4 m/sec and 0.65 m/sec, respectively. There was no difference in the standard deviations for thy heights during January; the average deviations were both around 0.5 m/sec. The standard deviation of hourly wind velocity at 90 m during the summer was relatively constant; 4 to 4.5 m/sec. However, it was not constant during the winter at 20 m or 90 m, and during the summer at 20 m; the standard deviation was greatest at noon. The frequencies of standard deviation in wind velocity are compared and examined in relation to the atmospheric stability classifications proposed by the Meteorological Agency in England. The comparison showed that the atmospheric stability classifications were not good parameters to evaluate pollutant diffusion.

49154 **APTIC NO. 71396**

Kawashima, E., T. Nakajima, Y. Izumi, H. Yoshida, and W. Kumata

ON THE LIMITATION OF METEOROLOGICAL PARAMETERS APPLICABLE TO THE PLUME MODEL. *(Purumu moderu no tekio dekiru kisho joken). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):286, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 140.*

The ability of the plume model to predict the sulfur dioxide level in the Kanazawa area is studied. The prediction is made based on the wind velocity and direction obtained by a sonde measurement, and the known amount of discharged SO2 in the area. On a snowing day, the predicted SO2 level was below the observed level indicating that snow acted as a scrubber of SO2. Under average meteorological conditions (such as atmospheric stability B or C), there was a 1-2 km shift of the area where the predicted SS2 concentration by the plume model was actually observed. This could have been caused by a distorted wind. Consideration of instability of the lower atmospheric layer affected by discharged heat from the ground was also necessary to predict the pollutant level more accurately.

49155 **APTIC NO. 70573**

Kertesz-Saringer, M., Z. Morlin, and E. Meszaros

SEPARATION OF AIR POLLUTING POLYCYCLIC AROMATIC HYDROCARONS FROM THE ATMOSPHERE. *(Ausscheidung luftverunreinigender polyzyklischer aromatischer Kohlenwasserstoffe aus der Atmosphaere). Text in German. Z. Ges. Hyg. Ihre Grenzgebiete (erlin), 20(11):766-768, 1974. 6 refs.*

The sedimentation speed of polycyclic aromatic hydrocarbons (PAH) on days with and without precipitation was calculated according to a given formula after the PAH content in dust samples was analyzed. In addition, the sedimented dust quantity and the quantity of airborne dust were measured. The following PAH were determined: anthracene, phenanthrene, 20-methylcholanthrene, fluoranthene, 1,2-benzanthracene, benzo-3,4-pyrene, perylene, 1,2,5,6-dibenzanthracene, 1,2-benzpyrene, 1,12-benzperylene, coronen, 3,4,9,10-dibenzpyrene, 1,2,3,4,-dibenzpyrene, chrysene, and pyrene. The samples were taken over a period of nearly two years from Nov. 1971 to Oct. 1973. Since PAH are mainly adsorbed on respirable dust particles their sedimentation speed is slower than that of total dust and amounts on the average to 6.4% of the sedimentation speed of total dust. According to earlier results 85% of benzo-3,4-pyrene is adsorbed on particles with a radius of less than 2-3 micron. Emitted PAH-compounds remain about 7 to 16 days in the atmosphere. Their residence time in the atmosphere is 16 times larger than that of total dust.

49156 **APTIC NO. 70418**

Kirsch, J. W. and B. F. Mason

EXPLOR (EXAMINATION OF POLLUTION LEVELS OF ROADWAYS) (FINAL TECHNICAL REPORT). *Systems, Science and Software, La Jolla, Calif., California Air Resources Board Contract ARB-659, Proj. 5D-207-7, Rept. SSS-R-74-2029, ARB-R-659-74-28, 94p., Jan. 15, 1974. 11 refs.*

A conservation of mass mathematical model with a second order advection-diffusion scheme known as EXPLOR (Examination of Pollution Levels of Roadways) was used to calculate off-roadway, ground-level carbon monoxide concentrations at four California locations. The model was validated by comparing predicted concentrations with measured data obtained at each location. The locations included at-grade, cut, and fill sections. The calculated values had a mean error of minus 0.34 ppm and a standard deviation of 1.09 ppm. These results are within the estimated error band due to inaccuracies in the experimental data. Although the EXPLOR code is designed for use under a wide variety of geometrical and meteorological conditions, validating data are available only to maximum distance of 600 ft from the roadway. Also, since major changes in concentration can occur with variation of the stability class, the user must be careful in determining the correct stability class. A user s guide is included.

49157 **APTIC NO. 71105**

Komuro, Isao

POLLUTANT DIFFUSION IN AREA OF PETROLEUM REFINERIES. *(Sekiyo konbinato sangyo haishutsu butsu no chiiki kakusan). Text in Japanese. Kankyo Sozo (Environ. Creation), 4(12):74-76, Dec. 1974. 2 refs. (Partial translation of Atmospheric Sanitary Problems around Petroleum Refineries and Petroleum Chemical Plants by M. L. Krasoritskaya, Moscow, 1972.)*

Pollutant diffusions in the surrounding area of a petroleum industrial conglomerate were surveyed over a period of 2 yr. To eliminate the effect of other industries, residential areas and automobiles, samples were collected in the wooded area and windward to 15 km distance. In this case, the pollutant concentration at 1 km compared to that at 0.5 km were reduced by 2/3 for hydrocarbons, 5/12 for carbon monoxide, 1/3 for hydrogen sulfide, 5/14 for sulfur dioxide and 5/9 for chlorinated HC. Windward pollutant concentrations compared to leeward concentrations were reduced 32.3-72.2% depending on the type of pollutant. The difference between daytime and night-time concentrations showed the effect of adverse meteorological conditions (temperature inversion). Dust concentrations in snow samples were 37.2 mg/sq m at 0.5 km and 14.8 mg/sq m at 2 km. Pollutant concentrations indoors were generally lower compared to those outdoors. Pollution characteristics of this area were relatively high stability of pollutants and extremely gradual decrease in pollutant concentration with distance.

49158 **APTIC NO. 71450**

Lvov, Y. A., N. V. Vasilev, and G. M. Ivanova

METHOD FOR THE DYNAMIC STUDY OF INDUSTRIAL DUST FALL OVER LARGE AREAS. *(Metod issledovaniya dinamiki vypadeniy promyshlennoy pyli na bol shikh ploshchadyakh). Text in Russian. Gigiena i Sanit., no. 8:97-98, 1974.*

Methods for the study of the dispersion of industrially emitted settling dust over large areas are described. One method consists of the microscopic detection of spherical, mostly magnetic, particles isolated from different layers of snow. Similar investigations at a distance of several hundred km from any industrial and residential area revealed the precipitation of 50-70 spherical particles in snow during the winter season. Another method consists of the microscopic analysis of such spherical particles ranging from 10 to 150 micron in size in ashed residues of Sphagnum fuscum from marshy areas.

49159 **APTIC NO. 70858**

MacCracken, M. C.

SECOND ANNUAL REPORT, DOT-CIAP PROGRAM. *California Univ., Livermore, Lawrence Livermore Lab., Atomic Energy Commission Contract W-7405-Eng-48, Dept. of Transportation-AS-20052, TID-4500, UC-11 Environmental and Earth Sciences UC-4 Chemistry, 175p., July 3, 1974. 185 refs.*

NTIS: UCRL-51336-74

The second annual report of the Climatic Impact Assessment Program (CIAP) is presented. The Program seeks to determine the effects of large numbers of aircraft operating in the stratosphere on global climate. Activities are summarized for each of these models: dispersion and transport; global transport and kinetics; zonal atmospheric; stratospheric kinetics; and radiation-transport. Among the findings are these: the minimum in ozone concentration achieved at the center of a plume is sensitive to transport, varying by as much as a factor of eight. The total amount of O_3 destroyed by a plume in a fixed time is insensitive, varying only about 25% over a wide range of diffusion coefficient. There is a linear relation between the nitrogen oxides injection rate and the O_3 destruction rate and center-point depletion.

49160 **APTIC NO. 71312**

Mogi, S., K. Goi, S. Imazeki, Y. Kobayashi, S. Yuzawa, H. Nobe, and H. Okano

ANALYSIS OF PHOTOCHEMICAL SMOG TRANSPORT BY WIND TRAJECTORY METHOD. *(Kokagaku sumoggu no ryusekisen kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):575, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 424.)*

The movement of surface wind is one of the important factors of photochemical oxidant pollution. The surface wind data were analyzed in terms of vector U (east-west component) and vector V (north-south component), and vector equations for U and V as functions of x and y (surface coordinates) were obtained. Based on the assumption that the air mass at time t1 is moved to a certain point at t2 according to the average wind velocity and wind direction, the wind direction and wind velocity at various points were calculated, and the wind trajectory was obtained. Using data measured at 22 points, the constants were obtained by the method of least squares. Applying this analysis method to data on April 25, 1973, the wind trajectory was drawn, and the variation in oxidant concentration on trajectory was obtained, which clearly showed oxidant concentration peaks in mid-afternoon.

49161 **APTIC NO. 71158**

Molina, Mario J. and F. S. Rowland

STRATOSPHERIC SINK FOR CHLOROFLUOROMETHANES--CHLORINE ATOM CATALYZED DESTRUCTION OF OZONE. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 29-34, Dec. 11-12, 1974. 25 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The probable sinks and lifetimes for chlorofluoromethanes were calculated. Two chlorofluoromethanes, difluorodichloromethane and fluorotrichloromethane can be detected throughout the troposphere in amounts (about 10 and 6 parts per 10 to the 11th power by volume, respectively) roughly corresponding to the integrated world industrial production to date. The most important sink for atmospheric $CFCl_3$ and CF_2Cl_2 appears to be stratospheric photolytic dissociation to $CFCl_2$ + Cl and to CF_2Cl + Cl, respectivley, at altitudes between 20-40 km. Photolysis does not occur in the troposphere because the molecules are transparent for wavelengths longer than 2300 A.

49162 **APTIC NO. 71159**

Molina, Mario J. and F. S. Rowland

PREDICTED PRESENT STRATOSPHERE ABUNDANCES OF CHLORINE SPECIES FROM PHOTODISSOCIATION OF CARBON TETRACHLORIDE. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 35-38, Dec. 11-12, 1974. 13 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

Vertical distributions for carbon tetrachloride and for chlorides formed by the stratospheric reactions of the photodecomposition products were calculated using a simple one-dimensional vertical eddy diffusion model. The continuity equation was solved for a constant input of CCl_4 at the tropopause, photodissociation as the sole sink for CCl_4, and diffusion back across the tropopause as the sole sink for chlorides. Rainout will rapidly remove hydrogen chloride in the troposphere. Calculations were normalized to fit an average CCl_4 tropospheric concentration of 7.3 times 10 to the -11th power v/v. The calculated altitude distributions of CCl_4 indicates only 20% of the tropospheric concentration at an altitude of 18 km. In the real atmosphere the altitude of the tropopause varies substantially with both season and latitude.

49163 **APTIC NO. 71119**

Mrose, Helmut

THE CHLORIDE CONTENT OF PRECIPITATION AT FOUR METEOROLOGICAL STATIONS IN THE INTERIOR OF MECKLENBURG. *(Der Chloridegehalt des Niederschlages an 4 meteorologischen Stationen im Mecklenburger Binnenland). Text in German. Z. Meteorol., 24(3-8):161-167, 1974. 11 refs.*

Regular measurements of the concentration of chloride in precipitation water were made at 4 stations in the northern part of the German Democratic Republic from 1965 to 1967. The data show an annual variation with a maximum in winter and a minimum in summer. The highest values occur during cyclonic air flow from NW and W caused by strong winds over the North Sea. High values are observed which cannot be explained by meteorological factors; they are probably caused by polluted air. The prevailing chloride concentration range varies between 1 and 2 mg/l at all stations. Extremely high values with concentrations of more than 20 mg/l are found only at the stations in Schwerin and Marnitz, which are situated in the westernmost part of the area. The chloride concentration is compared with data from other countries.

49164 **APTIC NO. 71168**

Nack, M. L. and A. E. S. Green

INFLUENCE OF CLOUDS, HAZE, AND SMOG ON THE MIDDLE ULTRAVIOLET REACHING THE GROUND. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 299-309, Dec. 11-12, 1974. 29 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The influence of clouds, haze, and smog upon instantaneous ground level direct, diffuse, and global ultraviolet radiation was investigated. The rigorous equations of Chandrasekhar were followed. The fact that it is capable of handling a cloud layer of large optical thickness with minimal subdivision of that layer permits a fast computer solution. A formalism for treating a fractional cloud layer is presented which allows the possibility of an increase in the global flux over the clear-sky case that was not allowed by the uniform layers. The ultraviolet spectral and dose results are compared with existing experimental data and averaged effects are presented and parameterized. (Author abstract modified)

49165 **APTIC NO. 71417**

Nakamura, K.

THE RELATION BETWEEN LOCAL WIND AND PHOTOCHEMICAL SMOG IN KANTO AREA. *(Kanto chiku no kyokuchifu to kokagaku sumoggu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):564, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 413.)*

The locality of photochemical smog formation is known to be greatly influenced by wind factors. The local wind pattern in the Kanto area was classified into five types based on stream line diagrams made at 9:00 am and 3:00 pm during the period of April to Sept. 1972. To further define these five types, the average pressure pattern and most wind direction of each type were analyzed in relation to the development of locally high oxidant concentrased based on data obtained during the period of July to Aug. 1973. Five local wind patterns, average pressure patterns, and most frequent wind direction are shown in diagrams. The combinations of wind patterns at 9:00 am and 3:00 pm were classified in the order of most frequent occurrence, and combinations associated with high oxidant concentration were specified.

49166 **APTIC NO. 70999**

Okamoto, Shinichi, Kiyoshige Shiozawa, Jun Hiroo, Takahito Akabayashi, and Atsushi Otaki

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION, PART VIII. *(Taiki osen nodo yosoku ni kansuru kenkyu, VIII). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):277, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 133.)*

The transition of air pollutant levels with time is considered within an imaginary box 2 sq km by 150 m in height. The 150-meter height is taken because this is the general height below the atmospheric inversion layer. The equation used to calculate the pollutant level transition is the function of wind velocity, pollutant emission rate, volume of the imaginary layer, and production and consumption rate of pollutants during photochemical reactions. Since horizontal diffusion is much slower than the horizontal movement of pollutants by wind, the horizontal diffusion term is deleted from the calculation. The theoretical carbon monoxide pollution level versus time is calculated for the Tokyo area. A known photochemical reaction model involving CO was also considered in the calculation. Although the rate constants for some photochemical reactions were inadequate, the calculated results were generally in good agreement with the observed CO level transition.

49167 **APTIC NO. 71388**

Oshino, Akira, Mitsuro Mizuma, Isao Sato, and Tsuneo Tsukatani

AIR POLLUTION BY A SINGLE AND LARGE SOURCE, PART 2. *(Tan itsu daihassegen ni yoru taiki osen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):295, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15, Chiba, Japan, Nov. 6-8, 1974, Paper 150.)*

Sulfur dioxide pollution levels in Misaki were studied in relation to sea wind and a single large SO2 source, the Tanagawa Power Station. The power station is located at the northern tip of a cape, Osaka is located north of the cape across Osaka Bay, while Misaki is located in the cape and south of the power station. The peak SO2 level in Misaki was observed around noon throughout the year, which generally coincided with northerly wind at this hour. The northerly wind usually changed to strong southerly wind in the afternoon, and the SO2 level decreased with the wind change. The northerly wind in April through June was the strongest of the year, and the monthly average SO2 level in these months was the highest of the year, 7 pphm. The highest hourly SO2 level was observed in June; 51 pphm; those in July, August, September, October, November, and December were 10, 11, 12, 9, 16, and 14 pphm respectively. These observations were explained in terms of the northerly wind. The southerly sea wind in the afternoon is a typical wind in the Osaka area.

49168 **APTIC NO. 71389**

Oshino, Akira, Isao Sato, Mitsuro Mizuma, and Tsuneo Tsukatani

AIR POLLUTION BY SINGLE AND LARGE SOURCE. *(Tan itsu dai hassegen ni yoru taiki osen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):294, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 149.)*

A theoretical calculation is made for the expected pollutant concentration at a remote receptor 2700 m from a single large pollution source. Only the variation in wind direction is considered and other factors for transporting pollutant to the receptor region are assumed to be constant. Whenever the wind does not blow toward the receptor, zero pollutant level at the receptor is assumed. Theoretical curves were computed for non-exceeding probability and frequency distribution of pollutant concentration at the receptor. Both curves were calculated for wind variances of 94, 188, 283, and 377 m.

49169 **APTIC NO. 70972**

Oya, Fumihiko, Kiyonobu Seki, and Jiro Yoshida

STUDY IN THE ENVIRONMENTAL POLLUTION FROM METEOROLOGICAL AIR POLLUTION INDEX, PART II: ENVIRONMENTAL FORECASTS FROM MAPI ANALYSES. *(Taiki osen kisho shisu ni yoru kankyo osen no kenkyu, dai 2 ho: taiki osen kisho shisu ni yoru kinkyuji kijun kento to yosoku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):266-Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 125.)*

The meteorological air pollution index (MAPI) is defined as the difference between a day s maximum and minimum temperature divided by the day s maximum wind velocity, and it serves to predict the pollution levels in different meteorological conditions. The use of MAPI for environmental pollution forecasting is considered. The MAPI value has been low since 1965, a year which had less pollutable atmospheric conditions. Calculations are made to see if higher MAPI values would indicate extremely dangerous sulfur dioxide and oxidant levels. Present SO2 emissions would not cause dangerous SO2 levels, however, oxidants could. To use the MAPI for an emergency pollution forecasting method, the wind velocity at 3 am and the minimum and maximum daily temperature in the MAPI definition can be used without making a large error in predicting the pollution level for that day.

49170 **APTIC NO. 70860**

Reiter, Reinhold, Walter Carnuth, Hans Joachim Kanter, and Rudolf Sladkovic

ANALYSIS OF AEROSOL TRANSPORT. *Inst. fuer Atmosphaerische Umweltforschung der Fraunhofer-Gesellschaft, Garmisch- Partenkirchen (West Germany), Army Grant DA-ERO-591-73-G0057, Program Element ITO61102B53A, Rept. DA-ERO-591-73-G0057, 73p., June 1974. 48 refs.*

Lidar reflectivities were systematically compared against both aerosol concentrations and aerological parameters, using cable cars as instrument carriers at high mountain stations. Eliminating local inhomogeneities, a very close relationship existed between lidar reflectivity and the logarithm of the number of condensation nuclei in the upper boundary of the haze layer which ascended to 2100 m. The logarithm of the number of condensation nuclei was indirectly derived from measurements of electrical conductivity of the air. Although the size distribution of the aerosol was in some cases doubtlessly controlled by relative humidity, a closer relation was nevertheless generally observed between lidar reflectivity and the number of condensation nuclei than between the former and relative humidity.

49171 **APTIC NO. 70470**

Rosen, J. M., R. G. Pinnick, and D. J. Hofman

STRATOSPHERIC AEROSOL MEASUREMENTS III: OPTICAL MODEL CALCULATIONS. *Wyoming Univ., Laramie, Dept. of Physics and Astronomy, Office of Naval Research Contract NOOO14-70-A- 0266-0005, Rept. GM-25, 43p., Dec. 1974. 35 refs.*

Mie single scattering, absorption, and total extinction calculations for various size distribution and composition models of the stratospheric aerosol are presented. The models are derived from numerous global in-situ measurements by a balloon-borne photoelectric counter during 1971-73. The global stratospheric aerosol mass loading calculated from these models is about 700,000 tons. The models are in agreement with simultaneous aerosol mass measurements made by aircraft filter sampling and by a balloon-borne impactor over Laramie, Wyoming. Nominal stratospheric aerosol optical depths at 0.53 micron wavelength are 0.005-0.007. The maximum stratospheric aerosol absorption cross-section at this wavelength is 0.00004/km at the 18-20 km altitude, assuming a refractive index imaginary part of 0.01. The predicted 180 deg backscatter lidar return at the 18-20 km altitude of maximum aerosol mixing ratio is 9% to 17% of the Rayleigh return at a wavelength of 0.6943 micron for the various aerosol models. Measured and predicted lidar returns over Laramie in September 1972 are in good agreement for several of the size distribution and composition models used. Values of the global stratospheric aerosol albedo at 0.53 micron are 0.002-0.003. (Author abstract modified)

49172 **APTIC NO. 71157**

Rowland, Sherry

AEROSOL SPRAYS AND THE OZONE SHIELD. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 22-25, Dec. 11-12, 1974. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The effect of aerosol sprays on the ozone shield is discussed. The chlorofluoromethane gases, difluorodichloromethane and fluorotrichloromethane are commonly used as propellants in aerosol sprays, and CF2Cl2 is the most widely used refrigerant gas. Annual world wide production of production of the two gases approaches 1 megaton. Free radicals are released into the stratosphere and are capable of attacking O3 and its precursor, atomic oxygen by catalytic chain processes through which a single free radical can remove hundreds or even thousands of O3 molecules. There is an additional 1% average global depletion of O3 from carbon tetrachloride which is common in urban areas. Other chlorinated molecules such as CH3CCl3, ChCl double bond CCl2, and CCl2 double bond Cl2 are released in quantities approaching 0.1 megaton/yr or more.

49173 **APTIC NO. 70819**

Russell, Philip B., William Viezee, and Richard D. Hake

LIDAR MEASUREMENTS OF STRATOSPHERIC AEROSOLS OVER MENLO PARK, CALIFORNIA: OCTOBER 1972-MARCH 1974 (FINAL REPORT). *Stanford Research Inst., Menlo Park, Calif., National Aeronautics and Space Administration Contract NAS2-7261, SRI Proj. 2217, 101p., June 1974. 66 refs.*

During an 18-month period, 30 nighttime observations of stratospheric aerosols were made using a ground-based ruby lidar located near the Pacific coast of central California. Vertical profiles of the lidar scattering ratio and the particulate backscattering coefficient were obtained by reference to a layer of assumed negligible particulate content. An aerosol layer centered near 21 km was clearly evident in all observations, but its magnitude and vertical distribution varied considerably throughout the observation period. A reduction of particulate backscattering in the 23 to 30 km layer during late Jan. 1973 appeared to be associated with the sudden stratospheric warming which occurred. Typically, a relative minimum in the ratio of particulate to molecular backscattering coefficients was observed near, but not necessarily at, the local tropopause. The maximum, or peak, value of this ratio at the ruby wavelength typically varied between 0.07 and 0.20. These values indicated a significant decrease in stratospheric particulate backscattering since the lidar observations in 1964-1965 which closely followed the Agung volcanic eruption. By using a model backscattering phase function, the lidar measurements were converted to stratospheric particulate optical thicknesses, yielding values between 0.002 and 0.005. Optical thickness was also less than following the volcanic eruptions. Lidar measurements compared to aircraft measurements provided support for the matching method of lidar analysis, which assumes a layer of negligible particulate backscattering within the altitude region over which the lidar signal is analyzed. Lidar observations are valuable sources of information on the stratospheric aerosol and can reveal the presence, altitude-dependence, backscattering strength, and variability in space and time of stratospheric aerosol layers. (Author summary modified)

49174 **APTIC NO. 70342**

Sakagami, Jiro

DIFFUSION IN THE ATMOSPHERE. *(Taikichu no kakusan). Text in Japanese. Preprint, Japan Society of Instrument and Control Engineers, Yokohama, p. 521-522, 1974. 2 refs. (Presented at the Japan Society of Instrument and Control Engineers, Lecture Meeting, 13th, Yokohama, Japan, Aug. 27-29, 1974.)*

The pollutants released into the atmosphere are carried away by wind and diffused three-dimensionally. There is interaction between flow phenomena and diffusion phenomena. When flow along level ground encounters hills and mountain ranges, the shape of the flow lines changes. Equations and graphs for atmospheric diffusion are included.

49175 **APTIC NO. 71393**

Sakagami, Jiro

COUNTEREVIDENCE OF THE GAUSSIAN PROFILE OF THE VERTICAL CONCENTRATION DISTRIBUTIONS. *(Seiki-gata enchoku nodo bunpu ni taisuru hansho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):289, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 144.)*

Comparison of the solutions for a differential diffusion equation is made. If the vertical diffusion coefficient is assumed to be constant regardless of the altitude, the approximate solution of the equation is that the logarithm of the concentration is proportional to the square of the height. If the vertical diffusion coefficient is assumed to vary with height, it is proportional to the vertical height. The results of the U. S. Green Glow Program in 1959 are compared with these assumptions, and the observed trend of pollutant diffusion in the program agreed with the model when the vertical diffusion coefficient was assumed to vary with height. This indicates that the normal distribution is not the correct treatment for atmospheric diffusion phenomena.

49176 **APTIC NO. 71108**

Sato, Junji and Minoru Moriguchi

MEASUREMENTS OF LOW LEVEL AIR TRAJECTORY WITH NON-LIFT BALLOON. PART II. *(Non rifuto barun kansoku ni tsuite, dai II ho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):264, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 123.)*

The movement of non-lift balloon is used to study air transport and diffusion. The vertical movement of the balloon was observed as a vibrational motion against time. The frequency of vertical balloon movement was almost same during two experiments conducted in the morning and afternoon; however, its amplitude was different between the two. The balloon tended to change its altitude 400 m + or - 350 m in the afternoon experiment, while the morning experiment showed 400 m + or - 150 m variation. The descending or ascending balloon velocity is calculated as a function of temperature. The calculated values were generally in good agreement with the regression curve obtained by Hass, for example the velocity was 0.4 m/sec for 0.6 C/100 m, and 0.85 m/sec for 1.0 C/100 m. Diffusion spread is obtained mathematically by the Lagrange correlation coefficient.

49177 **APTIC NO. 71094**

Shikata, Hiroshi

SIMULATION OF STACK GAS DISPERSION CONSIDERING THE INFLUENCE OF SOURCE SCALE. *(Tasu engen ni taisuru haien kakusan shimureshon shuho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):297, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 152.)*

An ideal diffusion simulation technique to predict environmental pollution of an area consisting of many different types of stacks is described. This technique is intended to reflect individual geological, meteorological, and chimney scale effects for flue gas diffusion, thus generalizing the applicability to any large scale industrial area. A plume model is basically applied. The parameters in the plume equation are determined by diffusion patterns which are classified in accord with generalized meteorological conditions and chimney characteristics. Generalized diffusion patterns do not reflect any individual chimney or location, and are thus subjected to variation. Uncertainty factors reflecting these individualities were therefore included in the treatment, and chimney height and diffusion correction factors were of major importance.

49178 **APTIC NO. 71387**

Shioya, M., S. Funabashi, K. Hasegawa, F. Miyamoto, and Y. Mogi

AIR POLLUTION PREDICTION BY ON-LINE SYSTEM I CATEGORICAL PREDICTION. *(On rain taiki osen yosoku hoshiki I kategori yosoku). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):280, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6- 8, 1974, Paper 136.)*

Forecasting of air pollution level by an on-line system is described. The on-line system treats all the information statistically. Previous data are categorized in two variables; thy phenomenal explanatory variable and the phenomenal standard variable, which are correlated indirectly by a third category termed a potential variable. Meteorological variables such as atmospheric pressure and temperature are also included in the treatment. The consideration of the on-line system is applied to forecast sulfur oxides pollution levels; light, medium, and heavy. Accuracy of the prediction was 90-94%.

49179 **APTIC NO. 71010**

Shiozawa, Kiyoshige, Atsushi Otaki, Jun Hiroo, and Shinichi Okamoto

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION. PART X. *(Taiki osen nodo no yosoku ni kansuru kenkyu (X)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):279, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 135.)*

Statistical treatment of air pollution data is considered in order to forecast pollutant levels. Variation of air pollutant levels consists of several cycles; therefore, by separating each cycle and by statistically calculating its periodicity, relatively accurate forecasts of air pollutant levels can be made. Such a calculation is made for sulfur dioxide and the predicted values compare favorably with observed SO2 data.

49180 **APTIC NO. 71121**

Sladek, I.

IMMISSION ALERT SERVICE FOR NORTHWEST BOHEMIA. *(Immissionswarnungsdienst fuer Nordwestboehmen). Text in German. Z. Meteorol., 24(3-8):168-172, 1974. 3 refs.*

A meteorological prediction method is presented for application to the so-called diurnal regional mean values of sulfur dioxide immission from 0700 to 0700 hr, Central European Time, in two areas of Chomutov County, Czechoslovakia, namely, the Erzgebirge and the lower Erzgebirge region. Based upon immission forecasts, the emission of selected sources can be controlled. The forecast includes, as a first step, the selection of one out of four weather types for the subsequent day. The weather types are defined by the air flow predominant at 850 mb and by the average vertical temperature lapse rate between the ground surface and the 850 mb level at 1300 and 0100 CET. This weather classification applies equally to the Erzgebirge and its lower regions. The most frequent weather type shows low SO2 immission which does not require emission control. For the three remaining weather types, multiple regression relations between SO2 immission, near-ground temperature, and the 850 mb wind speed were calculated for each type and each region. The regression relations are, based upon predicted values of the two meteorological parameters, used to determine the values of the expected diurnal and areal average of SO2 immission.

49181 **APTIC NO. 70875**

Stephens, J. Briscoe and P. A. Hamilton

DIFFUSION ALGORITHMS AND DATA REDUCTION ROUTINE FOR ONSITE LAUNCH PREDICTIONS FOR THE TRANSPORT OF TITAN III C EXHAUST EFFLUENTS. *National Aeronautics and Space Administration, Marshall Space Flight Center, Ala., George C. Marshall Space Flight Center, NASA-TN-D-7862, 85p., Dec. 1974. 5 refs.*

A multilayer diffusion model and calculator program is described for the real-time, on-line transport description of Titan III rocket exhaust dispersion utilizing ellipsoidal dispersion in a Eulerian reference frame. The real-time transport predictions at the launch rnage enable effluent monitoring teams to optimize their monitoring grids. The data reduction routine requires the meteorology profiles for the thermodynamics and kinematics of the atmosphere as input. These profiles are graphed along with the resulting exhaust cloud rise history, the center line concentrations and dosages, and the hydrogen chloride isopleths. The data preparation and reduction time for the calculator program is about a half hour.

49182 **APTIC NO. 70451**

Swank, Wayne T. and Gray S. Henderson

ATMOSPHERIC INPUT OF SOME CATIONS AND ANIONS TO FOREST ECOSYSTEMS IN NORTH

CAROLINA AND TENNESSEE. *American Geophysical Union, Washington, D. C., 24p., 1974. 23 refs. (Presented at the American Geophysical Union, Annual Meeting, 55th, Washington, D. C., April 1974.)*

The atmospheric contribution of elements in precipitation and dry fallout to forest ecosystems were contrasted at two sites in the southern Appalachians. Mean annual concentrations of cations in bulk precipitation showed that concentrations of metals decreased in the following order -- calcium, sodium, potassium, and magnesium at both sites. At the Coweeta Hydrologic Laboratory in North Carolina, the average annual inputs of Ca(++), Na(+), K(+), Mg(++), and ammonium ion in the period 1970-1973 were 4.88, 3.52, 1.62, 1.01, and 0.52 kg/ha/yr, respectively. At Walker Branch, Tenn., the inputs of these elements during the same time period were 15.73, 3.89, 2.99, 2.94, and 2.37 kg/ha/yr, respectively. The inputs of nitrate, phosphate, and chloride ions at Coweeta in 1972-1973 were 2.88, 0.19, and 8.59 kg/ha/yr, respectively; nitrate and phosphate inputs at Walker Branch for the period were 4.61 and 0.55 kg/ha/yr, respectively. One reason for differences in bulk precipitation chemistry was the contrasting dry fallout contributions. At Walkter Branch, elemental inputs from dry fallout were greater than bulk precipitation quantities at Coweeta for some cations. For both sites, dry fallout associated with local land use activities influenced seasonal concentration of bulk precipitation except for sodium ion, which appeared to be partly derived from marine sources. Total inputs of elements are considered to be minimum estimates for both forest ecosystems due to sampling and analytical methods. (Author abstract)

49183 **APTIC NO. 71391**

Takeuchi, Kiyohide

EULERIAN APPROACH TO NUMERICAL SIMULATION OF AIR POLLUTION. *(Taiki osen suchi shimureshion no oira teki kokoromi). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):291, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 146.*

An Eulerian approach to simulation of nitrogen oxides diffusion is considered. The anticipated NOx levels are calculated and compared with observed values. The NOx emission sources in the area are divided into four sq km blocks whose NOx emission rates are used for the calculation. The wind velocity and direction at different altitudes are measured by a balloon. All the necessary variables in the calculation are measured every hour. The calculated NOx concentration for three different places ranged between 4-18 pphm. The calculated concentrations at ground level in the afternoon were higher than the observed values. The calculation of altitude distribution of NOx gave lower levels than the observed levels; the calculated ground level NOx concentration at Setagaya was 4.5 pphm, and the concentration at 500 m altitude was 2 pphm, while the observed concentrations were 6 pphm and 4 pphm respectively.

49184 **APTIC NO. 71392**

Takeuchi, Kiyohide

LAGRANGIAN SIMULATION MODEL OF AIR POLLUTION. *(Raguranju ho niyoru taiki osen moderu). Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):290, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 145.)*

Simulated vertical diffusion of sulfur dioxide is calculated based on SO2 data collected in the Tokyo area. A simple diffusion equation in the Lagrangian simulation model is used. The calculation neglects horizontal diffusion, and considers only vertical diffusion. The vertical diffusion coefficients proposed by Eschenroeder in 1972 are used in the calculation. The height of the mixing layer is determined by a sonde observation. The best results are obtained when the transferring velocity of air mass was taken as 1.5 times the updraft velocity observed on the ground surface. The calculation showed that the 10 pphm SO2 at ground level became 3 pphm at 500 m and was below the pphm level at 1000 m.

49185 **APTIC NO. 71092**

Tanigawa, T., M. Sato, N. Mizutani, G. Ueda, T. Masuda, K. Hayashi, M. Nakano, and T. Hiraoka

ATMOSPHERIC DIFFUSION COMPUTATIONS IN OSAKA CITY: REPORT 4. *(Taiki kakusan keisan ni yoru taiki osen kiyo ritsu no suitei to sono oyo, IV). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):298, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 153.)*

An atmospheric diffusion calculation for sulfur dioxide is attempted for Osaka city. The calculation is intended to establish the overall emission standard for the area. The SO2 emission rates from 2200 pollution sources in the area and 220 more sources in surrounding areas are included in the calculation. Those factories which consume more than two kl fuel/day are considered as point sources, but the contribution from factories consuming lesser amounts of fuel is comulatively calculated as a block area source of 250,000 sq m. The SO2 averages were calculated for the winter and on an annual basis by using the Pasquill equation. The calculation for effective stack height was made using the modified Priestly and Concaine equation. No result was given.

49186 **APTIC NO. 71093**

Tsuneoka, Masayoshi, Yoichi Tao, Hiroshi Yamashita, and Hisao Ota

PREDICTION OF SO2 CONCENTRATION BY COMBINED SIMULATION MODELS. *(Chiba-ken ni okeru iosankabutsu nodo no kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):296, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 151.)*

Prediction of sulfur dioxide level in the city of Ichihara in Chiba Prefecture is attempted. Ichihara is located near a large industrial area along the Tokyo bay and sea wind greatly affects the SO2 level in surrounding cities. The calculation is based on the discharged SO2 amounts from 33 factories in the area and meteorological observations. The calculation used a combined simulation of box and puff models. The Puff model is reflected in the calculation only for those factories located close to the city. The two models are correlated, thus allowing better prediction of pollution levels.

49187 **APTIC NO. 71360**

Uchiyama, Masahiro

ON THE RELATION BETWEEN METEOROLOGICAL PARAMETERS AND CONCENTRATION OF SO2 AROUND SOURCES. *(Hasseigen shuhen no fuko, fusoku to aryusangasu nodo tono kankei). Text in Japanese. Taiki Osen Kenkyu (J. Japan.Soc. Air Pollution), 9(2):524, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 372.)*

The effect of wind direction on air pollution levels at monitoring stations was studied. Four stations surrounding a single pollution source were chosen. The contribution of the pollutant discharged by this source to the pollution level observed at the stations was determined. The calculation was based on the observed pollution levels with the without a wind from the pollution source. Whenever no wind blew from the source to a station, the observed level at the station was taken as the background level, and this background value determined the contribition of the square. Maximum contribution of 83.8% was observed at one station and the average contribution was 64.9% at this location. A smaller contribution was found when as the distance between source and station increased. At the station located 1 km from the source, the maximum contribution was 46.7% and the average contribution was 11.1%.

49188 **APTIC NO. 71003**

Wakamatsu, Shinji

MATHEMATICAL MODEL OF AIR POLLUTANT CONCENTRATION: THE RELATIONSHIP BETWEEN ONE HOUR AVERAGE AND ANNUAL AVERAGE OF SULFUR OXIDES CONCENTRATION. *(Taiki osenbutsu nodo no hyoka ni tsuite, nenhekinchi suitei no tame no sugaku moderu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):270, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 128.)*

A general mathematical treatment is described which allows prediction of the annual mean value of sulfur oxides from hourly averages obtained from a relatively small number of SOx measurements. The paper contains 14 equations for this purpose, and explains each step of the calculation.

49189 **APTIC NO. 71164**

Wofsy, Steven C. and Michael B. McElroy

HOX, NOX, AND CLOX: THEIR ROLE IN ATMOSPHERIC PHOTOCHEMISTRY. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 253-262, Dec. 11-12, 1974. 67 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The atmospheric reactions of HO2 and hydroxide with ozone are discussed. Ozone and OH form oxygen and HO2(A) while O3 and HO2 form OH and O2(B). These reactions may provide an important sink for tropospheric odd O2 such that O3 may not be a passive tracer for tropospheric motions. The relative importance of the sources and sinks depend on the branching of HO2. Reactions A and B could provide a height integrated sink for tropospheric O3 of about 2 times 10 to the 11th power molecules cm to the -2nd/s, comparable to the total flux of O3 believed to emanate from the stratosphere. As a consequence of the large rates for A and B, the distribution of tropospheric O3 may be directly affected by local chemistry.

49190 **APTIC NO. 71395**

Yamamoto, S. and O. Yokoyama

A PRACTICAL METHOD FOR ESTIMATING THE DISPERSION OF PLUMES. *(Enryu kakusan haba no suiteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):287, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 142.)*

An estimation method for smoke dispersion width applicable to a high chimney is developed. Atmospheric stability does not affect the ratio between the horizontal dispersion width and standard deviation of horizontal wind direction, and the ratio equals 0.018 times the distance from the chimney. However, the ratio between vertical dispersion width and standard deviation of vertical wind direction depends on the atmospheric stability, and the ratio equals 0.00539 times the distance from the chimney times the atmospheric stability constant. The constant ranges between 2.67 for Pasquill s atmospheric stability A to 0.829 for stability E. The horizontal dispersion widths for high chimney are plotted against the distance from the chimney, and compared with those obtained by the Pasquill method. The present method gives steeper slopes for the plot. To apply the method, standard deviations of horizontal and vertical wind direction must be known, or they must be estimated from data of wind velocity, direction, or atmospheric temperature.

49191 **APTIC NO. 71394**

Yokoyama, O., M. Gamou, and S. Yamamoto

STRUCTURE OF MIXING LAYER AND DIFFUSION MODEL. *(Kongoso no kozo to kakusan moderu). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):288, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 143.)*

The structure of the mixing layer is studied at the southern part of Kanto Plain which has small variation in horizontal wind velocity. Data are collected for average updraft velocity, turbulent flow, and atmospheric temperature from which energy spectra, turbulent flow energy loss, and vertical diffusion coefficients for pollutants are obtained. Atmospheric temperatures within the mixing layer increased smoothly with altitude; however, inversion of temperature occurred above the mixing layer. The height of mixing layer is defined as a sudden drop in the turbulent flow energy loss. It was 500 m at 8 am and increased to 1200 m by 11 am. The height increased with the sq power of cumulative amounts of sunlight. Variation of standard deviations in updraft velocity and temperature with altitude was very small within the mixing layer. The distribution of vertical diffusion coefficients within a mixing layer was uniform, however a higher mixing layer gave a larger diffusion coefficient.

49192 **APTIC NO. 70588**

Mito Weather Observatory (Japan)

METEOROLOGICAL ANALYSIS AND INVESTIGATION OF PHOTOCHEMICAL SMOG FORMATION IN IARAKI PREFECTURE. *(Ibaraki-ken ni okeru kokagaku sumoggu hassei no kisho kaiseki, chosa ni tsuite). Text in Japanese. Tokan Gijutsu Nyusu (Tokan Technol. News), no. 35:31-47, Feb. 1974. 7 refs.*

In Ibaraki Prefecture, photochemical smog alarms were issued 27 days in the period from July to Oct. 1972. The oxidant concentration was measured at four points, and meteorological data, wind direction, wind velocity, temperature, and weather, obtained at nearby four locations, were analyzed. The maximum oxidant concentration and average maximum concentration were 0.270 ppm and 0.167 ppm, respectively. The relationship between oxidant maximum concentration and maximum temperature, maximum wind velocity, frequency of wind direction, or inversion layer were analyzed. The alarm days were classified into four types, and the surface chart, wind convergence line, and sea breeze front of each type of pollution day were analyzed. The meteorological data in the upper atmosphere (wind, temperature) were also analyzed according to the four classifications. The probable contributing factors to high oxidant concentrations were the wind convergence lines developed in early morning and the sea breeze fronts which moved northward from the Tokyo area. However, the triggering factor of high oxidant concentrations were south wind from the Keiyo industrial area.

1973

49193 **APTIC NO. 70224**

Armstrong, J. G.

INSTRUMENTATION OF THE GORE HILL T.V. TOWER WITH ANALYSIS OF ONE YEAR S TEMPERATURE DATA AT THREE LEVELS. *Clean Air Society of Australia and New Zealand, New South Wales ranch, Air Pollut. Control Instrum., Proc. Symp., Sydney, Australia, 1973, p. 4-1 to 4-17. 2 refs. (Sept. 18, Paper 4.)*

In general, air pollution dispersion in the lower layers of the atmosphere depends on two main meteorological parameters, wind speed and direction throughout the layers and stability of the atmosphere. Instrumentation on the Gore Hill Television Tower designed to sample air temperature (which defines static stability of lower layers at any instant in time) at three levels along with wind speed and direction is discussed. Low level temperature and/or wind profiles can be measured by airborne sensors with a suitable telemetry link to the ground which are either free or in captive flight (such as balloons, kites, kitoons, and model aircraft), instrumented towers, and indirect methods (such as acoustic sounders or lidar). The tower at Gore Hill was instrumented at 10, 50, and 110 m above the base of the tower. Temperature sensing was conducted by sheathed platinum resistance thermometers. Wind direction was measured by three synchrotac potentiometric wind vanes; wind speed was recorded by reed switch anemometers. Inversions of at least 1-hour long occurred on 262 nights, i.e., 73% of the nights of the year. Inversions were practically a nightly occurrence in the cooler months of the year. A malfunction of the wind speed sensors occurred, but data on the Dines Anemograph at Observatory Hill showed that about 70% of the inversions were associated with a wind speed of less than 2.5 m/sec. The wind direction was generally from the west to the northwest.

49194 **APTIC NO. 70460**

Bernstein, Abram Bernard

A GENERALIZED THREE-DIMENSIONAL MIXING LENGTH MODEL APPLIED TO TURBULENT TRANSFER IN THE ATMOSPHERIC SURFACE LAYER. *Washington Univ., Seattle, Dept. of Atmospheric Sciences, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-2198, 1973, 150p. 61 refs.*

A generalized three-dimensional mixing length model was applied to turbulent transfer in the atmospheric surface layer. The model leads to relations between fluxes and gradients which involve more than simple eddy transfer coefficients, and the theory remains manageable only when it is kept linear. The model indicates the necessity for measuring the complete three- dimensional behavior of both fluxes and gradients in order to discover the laws of turbulent transport in regions of wind shear, rather than concentrating on vertical components as has been done in the past. Tests of the assumption of the Prandtl model that anomalies of vertical velocity and transferred scalar property vanish simultaneously showed that this assumption is apparently not the case.

49195 **APTIC NO. 70816**

Duce, R. A., G. L. Hoffman, J. L. Fasching, and J. L. Moyers

THE COLLECTION AND ANALYSIS OF TRACE ELEMENTS IN ATMOSPHERIC PARTICULATE MATTER OVER THE NORTH ATLANTIC OCEAN. *World Meteorological Organization, Geneva (Switzerland) and World Health Organization, Geneva (Switzerland), Tech. Conf. Observ. Meas. Atmos. Pollut., Helsinki, Finland, 1973, p. 370-379. 17 refs. (July 30-Aug. 4.)*

Various trace elements such as metals, pesticides, and hydrocarbons reach the ocean via the atmosphere. The long-range transport of pollutants was studied in mid-ocean regions over the North Atlantic. The rate and mechanisms of the removal of heavy metals, petroleum products, and chlorinated hydrocarbons were studied. The primary atmospheric sampling site was on Bermuda. Samples were also taken from a ship at various areas. Samples were collected in the northeast tradewinds which often contain material from the African continent and in the westerlies which often contain particulates from North America. Iron, aluminum, Scandian, manganese, lanthanum, chromium, and cobalt all had a crustal weathering source over the regions of the Atlantic Ocean. Vanadium appeared to have a crustal source in the trades, but is considerably enriched in the westerlies. Lead and antimony showed significant enrichment in both areas, but the enrichment was much greater in the westerlies than the trades. The elements copper, arsenic, and selenium also markedly enriched the atmospheric samples, suggesting that normal crustal weathering is not the source of this elements. The difference in the enrichments of vanadium, lead, and antimony in the two regions is probably a result of the addition of large quantities of Sahara dust to the background aerosol in the trades, reducing the enrichment values for those elements whose source is not crustal weathering. The results from the westerlies are in good agreement with those from a similar study at the South Pole. The sources of the high enrichment values for V, Cu, As, Pb, Sb, and Se have not yet been determined with certainty, although a combination of anthropogenic and natural processes is suspected.

49196 **APTIC NO. 71243**

Hogstrom, U.

RESIDENCE TIME OF SULFUROUS AIR POLLUTANTS FROM A LOCAL SOURCE DURING PRECIPITATION. *Ambio, 2(1-2):37-41, 1973. 6 refs.*

Sulfate deposition and precipitation acidity were measured at distances of 3.5-60 km from the center of Uppsala during a number of well-defined rainfalls and snowfalls to study the transport and washout of sulfur emissions. Uppsala was the only large sulfur source in the study area. Analysis of data from five experiments revealed residence times of 1-2 hr for sulfates and strong acids, corresponding to travel distances ranging from 50-100 km. Estimates of the relative contribution of sources in the city to the observed total sulfur fallout indicated that 25-50% of the observed deposition is produced by sources within a radius of less than 100 km from the measuring point. High deposition values appear to occur in a 50-100 km radius around the city rather than in the city itself.

49197 **APTIC NO. 70866**

Livshits, G. S., Z. V. Karyagina, D. A. Rozhkovshiy, and T. B. Omorov (Eds.)

SCATTERING AND ABSORPTION OF LIGHT IN THE ATMOSPHERE. *(Rasseyaniyo i Pogloshcheniye Sveta v Atmosfere). Tr. Astrofiz. Inst., Akad, Nauk Kaz-SSR, vol. 18, Nauka Press, Kazaku SSR, Alma-Ata, 1971. 167 refs. Translated from Russian. Leo Kanner Assoc., 206p., Dec. 4, 1973.*

NTIS, DDC: AD 781013

The scattering and absorption of light in the atmosphere were investigated. The specific topics include: formula for the brightness of the daytime sky; brightness and polarization of the sky in the solar almucantar in the near infrared region of the spectrum; scattering indicatrix of light in the atmosphere in the near infrared region; interrelation between the absolute brightness indicatrix of the daytime sky and the optical thickness of the atmosphere; optical characteristics of the clear daytime sky in the visible region of the spectrum and atmospheric aerosols; circumsolar aureole and atmospheric aerosols; spectral measurements of sky brightness; spectral brightness of the sky at small angular distances from the sun and the aerosol spectrum; seasonal mean optical parameters of atmospheric aerosols; circumsolar aureole and aerosol spectrum in the Steppe areas of Kazakhstan; the ratio of the number of large and small particles in the spectrum of the atmospheric aerosols; seasonal variations in the terrain albedo; possibility of polarimetric monitoring of the optical stability of the atmosphere; spectroelectrophotometer for atmospheric optical measurements in the near infrared region of the spectrum; spectropolarimeter for the daytime sky for the ultraviolet region of the spectrum; investigation of light absorption in aerosols; spectral transparency and scattering indicatrices of certain turbid media; optical properties of polydisperse media with different size distributions; measurements of transparency in the atmospheric layer near the earth at various wavelengths; use of a fabri-perot standard for the study of atmospheric absorption spectra; spectral variation of transparency and scattering indicatrix of urban haze; determination of the instrumental contour of the DFS-13 diffraction spectrograph; and light scattering indicatrices in the atmospheric layer near the earth in the region of large scattering angles.

49198 **APTIC NO. 70811**

Mahapatra, Aswini K.

AN EVALUATION OF A SPECTRORADIOMETER FOR THE VISIBLE AND NEAR UV. *Missouri Univ., Columbia, Dept. of Physics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1973, 134p. 39 refs.*

A photomultiplier-filter-spectroradiometer was tested for its effectiveness to continuously record the spectra intensity distribution of direct sunlight at selected narrow wavebands in the visible and near ultraviolet regions. The wavelengths at maximum transmission of 12 interference filters and the spectral reflectance of two heliostat mirrors were determined by means of a CARY spectrophotometer. Clear days were chosen for the measurement of spectral intensity of direct solar radiation and the spectral irradiance at normal incidence measured at different hours of the day. Estimation of the spectral energy distribution of solar radiation at selected wavebands was possible when the instrument was calibrated and operated with care, and a graphical technique yielded reasonable estimates of solar irradiance at normal incidence outside the atmosphere for most of the wavelengths studied. Estimates of inconsistent values of total and aerosol optical depth at long wavelengths indicated the need for further modification of the instrument s electronics. The attenuation of direct solar radiation in the visible and near ultraviolet by various atmospheric constituents was treated according to an empirical model, considering the scattering by normal air molecules, water vapor, dust, and ozone absorption. The transmission coefficient of the atmosphere thus estimated from the model did not agree with the estimation based on observational data of spectral intensity on the surface. Estimation of the spectral intensity of solar radiation at the surface appears possible only by the use of either a spectroradiometer, such as the one tested, or an attenuation model of the atmosphere which predicts accurately the solar intensity at the surface from known values at the top of the atmosphere.

49199 **APTIC NO. 70478**

Montgomery, T. L., J. M. Leavitt, T. L. Crawford, and F. E. Gartrell

CONTROLLING AMBIENT SO2. *In: Nondegradation Policy of the Clean Air Act. 93rd Congress (Senate), Serial 93-H16, p. 150- 160, July 24, 1973. 5 refs. (Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works.)*

GPO

The Tennessee Valley Authority s program to control ground level sulfur dioxide concentrations is reviewed. The impact of the ambient concentrations of SO2 from coal-fired power plants on the surrounding environment has been studied since the early 1950s. A noncontinuous SO2 emission limitation program was set up around the three-unit Paradise Steam Plant during adverse dispersion conditions. Three elements were involved in the development of the SO2 emission limitation program for the Paradise Steam Plant -- maximum ground level SO2 concentrations, critical plume dispersion model, and program implementation criteria. These three elements were integrated into the program during intensive field studies and data evaluation prior to the initiation of the program in Sept. 1969. In Sept. 1971, an SO2 emission limitation program was initiated at the Widows Creek Steam Plant in north Alabama, 28 miles southwest of Chattanooga, Tenn. This was a more limited program designed to prevent excessive ground level SO2 concentrations from occurring on an adjacent plateau directly across the river and some 275 yards above the valley site of the plant. The program achieves emission limitations by selective burning of low-sulfur coal and/or the reduction of plant generating load during critical meteorological conditions. In late 1972, a third SO2 emission limitation program was initiated at the recently constructed Cumberland Steam Plant, located about 40 miles west of Nashville. This plant is one of the world s largest with two 1300 mw units, each with a 305-meter stack. The program will be similar to the one at the Paradise plant. Noncontinuous emission limitation programs are expected to play an important role in the Tennessee Valley Authority s efforts to achieve air quality goals in the Tennessee Valley region.

49200 **APTIC NO. 70446**

Ottar, B.

THE LONG RANGE TRANSPORT OF AIR POLLUTANTS A COOPERATIVE TECHNICAL PROGRAMME OF OECD. *Preprint, Norwegian Inst. for Air Research, Kjeller (Norway), 8p., July 27, 1973. 6 refs.*

The long range transport of air pollutants, in particular sulfur dioxide and sulfuric acid, in Western Europe was investigated. An emission survey was made, and atmospheric dispersion models were developed. The calculated concentrations show promising agreement with measured values. Considerable amounts of H2SO4 and other pollutants are transported from the central industrial areas in Europe and deposited with precipitation in the Scandinavian area. The largest source area in Eastern Germany with adjoining parts of Czechoslovakia and Poland which emits 10-11 million tons of SO2/yr. The highest pollution levels occur in a high pressure situation with inversions and low winds and cause an accumulation of the pollutants in the source areas before transportation takes place. Such situations with highly polluted air and markedly acid precipitation occur 10-30 times/yr. When the pollution originates from the western part of Europe, an appreciable amount of nitrate ions is found in the acid precipitation. This is due to differences of fuel and in the extent of traffic.

49201 **APTIC NO. 70480**

Perroud, P., G. Pleyber, and M. Sylvestre-Baron

THE USE OF CAPTIVE BALLOONS FOR AIR POLLUTION STUDY IN THE LOWER LAYERS OF THE ATMOSPHERE. *(Utilisation de ballons captifs pour l etude de la pollution dans les basses couches de l atmosphere). Text in French. Atomic Energy Commissariat, Grenoble (France), Nuclear Research Center, Rept. CENG/ASP 73-11, 1973. (Presented at the AERALL 1973 Colloquium, Paris, France, Nov. 12-14, 1973.)*

NTIS: CEA-CONF-2491

The use of captive balloons for air pollutant concentration measurements and actual measurements of sulfur dioxide, chlorine, and hydrocarbon concentrations are discussed. Certain meteorological factors, such as humidity, pressure, temperature, wind speed, as well as vertical profiles of these parameters were measured along with those of the pollutants. In the absence of inversion, the SO2 concentration decreased rapidly with altitude in the surface layer of the atmosphere to increase again at higher altitude. The vertical profile of the hydrocarbon concentrations showed a similar pattern, while the chlorine concentration increased from very low values with altitude to stabilize at a certain level. Accumulation of the pollutants below inversion layers was evidenced.

49202 **APTIC NO. 70481**

Perroud, P., M. Sylvestre-Baron, G. Pleyber, P. Perilhon, R. Faivre-Pierret, A. Closson, and C. Nicotra

AIR POLLUTION MEASUREMENT IN THE LOWER LAYERS OF THE ATMOSPHERE. THE USE OF CAPTIVE BALLOONS. *(Mesures de pollution dans les basses couches de l atmosphere. Emploi de ballons captifs). Text in French. Preprint, Commissariat a l Energie Atomique, Paris (France), 23p., 1973. 1 ref. (Presented at the Colloquium on Pollution Control Techniques, Grenoble, France, Oct. 2-6, 1973.*

Experimental air pollution measurements in the lower layers of the atmosphere were conducted by means of a captive balloon equipped with instruments for the measurement of meteorological parameters, such as pressure, temperature, humidity, and wind speed, as well as of sulfur dioxide, chlorine, and organic pollutant concentrations. Chlorine was determined by the colorimetric method, using methyl orange as a reagent, while SO2 was determined by the West-Gaeke method at a sensitivity of 5 micrograms/cu m. Hydrocarbons were trapped by means of liquid nitrogen for subsequent gas chromatographic determination at a sensitivity of 0.1 microgram/cu m. Actual measurements revealed relationships between the pollutant concentrations and inversion layers, as well as differences in the vertical diffusion of different air pollutants.

49203 **APTIC NO. 70468**

Reiter, Elmar R.

TRACE GASES, AEROSOLS, AND SOLAR RADIATION IN THE STRATOSPHERE -- EXPLORED AND UNEXPLORED PROBLEM AREAS. *Preprint, American Inst. of Aeronautics and Astronautics, New York and American Meterological Society, Boston, Mass., 10p., 1973. 13 refs. (Presented at the Conference on the Environmental Impact of Aerospace Operations in the High Atmosphere, Proc., Denver, Colo., June 11-13, 1973, Paper 73-509.)*

The Climatic Impact Assessment Program (CIAP) of the Department of Transportation is faced with the task of providing a detailed review of the undisturbed stratosphere as it exists before the start of supersonic transport traffic. The highlights of present knowledge of the stratosphere, especially with respect to the ozone, nitrogen oxide, and water problems are described. Some of the deficiencies in this knolwledge are presented which will have to be overcome before a complete assessement of human impact on the stratosphere can be made. Ozone, even though a minor constituent of the atmosphere, is important because it blocks ultraviolet radiation at wavelengths less than 3000 A. The latitudinal distribution, seasonal variation, hemispheric differences, secular variations, and short-term fluctuations of ozone are described. Since oxides of nitrogen play an important role in the catalytic destruction of ozone, the chemistry and photochemistry of NOx are important in considering the impact of the supersonic transport on the environment. Ozone not only is affected by radiation fluxes in the atmosphere but also effects them. The presence of aerosols may change the radiation fluxes in the ozone layer significantly. (Author abstract modified)

49204 **APTIC NO. 70842**

Shirvaikar, V. V.

METEOROLOGICAL CONSIDERATIONS IN AIR POLLUTION CONTROL. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 129-147. 5 refs. (Sept. 11-12.)*

The application of local meteorological considerations to the control of air pollution is discussed in relation to already existing industries and planned industrial complexes. Emission standards for single isolated plants can be readily met by estimating the maximum pollutant emission rate, calculating pollutant concentrations for various chimney heights based on meteorological data (stability, wind speed, and wind direction), and choosing a chimney height such that concentrations are within permissible limits. Assessing the effect of industrial complexes additionally involves the mapping of sources and chimney heights and considering the change in site roughness because of structures. Main contributors can then be identified and controls enforced. The planning of an industrial complex can be done based on apportionment, using meteorological input and pollution concentration data for a given area. The application of diffusion models is illustrated with sample calculations of sulfur dioxide contributions from an industrial complex under various stability conditions.

49205 **APTIC NO. 70403**

Sundararaman, Narasimhan

SOME CONSEQUENCES OF THE ABSORPTION OF SOLAR ULTRAVIOLET RADIATION BY ATMOSPHERIC OZONE. *California Univ., Los Angeles, Dept. of Physics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-11,576, 1973, 274p. 57 refs.*

The consequences of absorption of solar ultraviolet radiation by ozone and molecular oxygen in the earth s upper atmosphere are investigated. The basic methodology of calculating the radiative transfer in a planetary atmosphere with Rayleigh scattering and height-dependent ozone absorption is discussed and applied to determine the climatology of the ultraviolet radiation field for the wavelengths 305.5, 308.8, 311.4, 317.6, 325.4, and 339.8 nm. Atmospheric tidal theory is also reviewed, and the results of a new calculation for lunar barometric tide are given. Tidal generation by absorption of solar infrared radiation by tropospheric water vapor is studied with longitudinally-dependent water vapor distributions. The local generation of tides by heating due to molecular oxygen is important at ionospheric altitudes. The current predictions of ozone decreases due to supersonic transports range as high as 15%; at 305.5 nm an assumed ozone decrease of as little as 2% causes a 5% increase in both the direct and diffuse fluxes when the sun is 30 deg above the horizon. The increases are smaller for other wavelengths and for higher positions of the sun in the sky. (Author abstract modified)

49206 **APTIC NO. 70461**

Trout, Dennis A.

AN EFFECTIVE POINT SOURCE MODEL FOR A LARGE URBAN COMPLEX TO ESTIMATE CONCENTRATIONS OF AIR POLLUTANTS AT MESO-SCALE DISTANCES. *Pennsylvania State Univ., College Park, Dept. of Meteorology, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-4296, 1973, 123p. 89 refs.*

An effective point source model for measuring pollutant concentrations at meso-scale distances from a large urban complex was developed. The model was derived from the principle of conservation of mass and a Gaussian distribution lateral to the plume axis. The lateral spread of the plume was given as a function of the downwind distance from the effective point source and the stability class according to Pasquill s empirical curves extrapolated to mesoscale distances. Transport wind speed and direction as well as mixing depth were determined from radiosonde soundings in the St. Louis area. Stability classes were determined from hourly surface observations of cloud cover and wind and with the aid of scaled surface air streak lines. Sulfur dioxide concentrations from the urban St. Louis area and a nearby urban complex were measured at distances up to 150 km downwind under sustained, elevated, low-level inversion conditions on certain days during November 1970 and January and February 1971. While concentrations of sulfur dioxide measured below the base of the inversion were uniform in the vertical, measurements above the base of the inversion showed concentrations of sulfur dioxide to be negligible. More than 90% of the observed concentrations fell within a factor of two of the predicted values, and the correlation coefficient for all cases analyzed was greater than 0.80. (Author summary modified)

49207 **APTIC NO. 71153**

Winges, Kirk D., Edward A. Grens, II, and Theodore Vermeulen

DISPERSION OF GASEOUS EMISSIONS FROM A GROUND-LEVEL LINE SOURCE. *California Univ., Berkeley, Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-eng-48, 97p., Nov. 19, 1973. 54 refs.*

NTIS: LBL-2444

The spread of vehicular pollutants from along a freeway can be modeled by a family of cross-sectional planes, usually taken perpendicular to the freeway axis. When calculations in such a plane are carried out using a finite-element grid, the emission source can be represented as one, or several, of the two-dimensional grid elements. Relations between velocity and turbulent transport were redeveloped from conventional equations for conservation of momentum and of matter. Three elementary cases were considered in this initial study toward future comprehensive analysis of freeway configurations by a continuity method: parallel flow over a uniform plane; flow over a discontinuity in surface roughness; and, the most significant for the freeway problem, flow over a perpendicular barrier attached to a uniform plane. The velocity profiles used for these respective cases were based, first, on both logarithmic and power-law models; second, on data from Plate; and third, on wind tunnel data from Nagabhushaniah. In the barrier-flow case, the pressure field was estimated by assuming potential, or inviscid, flow. In all three cases, the turbulent transport was characterized by an eddy viscosity for momentum transfer and by an eddy diffusivity for mass transfer, which were set equal and were calculated by the momentum equations. Concentration profiles were computed in each case for the region downwind from a ground-level emission source. These calculations demonstrated the feasibility of predicitng concentration profiles by the continuity method in configurations for which the velocity and pressure profiles are known or predictable. (Author abstract)

49208 **APTIC NO. 70462**

Wu, Ming-Shian

SCAVENGING OF ATMOSPHERIC PARTICLES BY WATER DROPS. *Missouri Univ., Rolla, Dept. of Chemistry, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., order no. 74-4377, 1973, 72p. 63 refs.*

Mechanisms of particle capture and coalescence of aerosols by a moving water drop in the atmosphere are studied using the boundary-layer flow approximation. Particle trajectory is computed by solving the equations of motion of the particle both outside and inside the boundary layer using the Adams-Moulton method, and the grazing trajectory is found by a trial-and-error technique. Computation of the collision and collection efficiencies of scavenging due to particle inertia and to the velocity gradient of the flow field for water drops ranging from 0.1-1.0 mm in radius and for particles of 1-10 micron in radius results in good agreement with experimental data. Studies on the effects of intermolecular forces on the collection efficiency of submicron aerosol particles in which numerical results are obtained for the cases of a water drop collecting silver chloride aerosols and submicron cloud droplets indicate that the collection efficiency depends mainly on the diffusion process. The calculations agree reasonably well with experimental results for silver chloride aerosols for the case of a small drop. (Author abstract modified)

1972

49209 **APTIC NO. 71250**

Kapoor, R. K., L. T. Khemani, and B. V. Ramana Murty

CHEMICAL COMPOSITION OF RAIN WATER AND RAIN CHARACTERISTICS AT DELHI. II. *Tellus (Uppsala), 24(6):575-580, 1972. 10 refs.*

Rain-water samples collected at Delhi between 1964 and 1967 were analyzed for nitrate, ammonium, and sulfate and were examined in relation to total seasonal rainfall, type of rainfall, and its intensity. Ammonium concentration varied from 0.20-0.34 ppm, nitrate concentrations from 0.47-1.37 ppm, and sulfate concentrations from 2.05-3.39 ppm over the sampling period. Ratios of nitrate/sulfate and nitrate/ammonium were closely associated with the behavior of the monsoon and were lower for heavy rains. Seasonal comparisons revealed that all three constituents measured were higher during the winter than during the monsoon. Warm convective type rains were associated with a minimum concentration of ice nuclei in surface air layers (16.4 cu m) and a maximum ratio of nitrate/ammonium in rain water (4.96), while cold layer situations were associated with maximum concentrations of ice nuclei in surface air layers (45.5 cu m) and minimum nitrate/ammonium ratios in rain water (2.30). The ammonium/sulfate ratio was minimum in warm convective type situations (0.06) and maximum in cold layer situations (0.19). The causes of the variations in rainwater composition with precipitation activity were not ascertained.

49210 **APTIC NO. 70420**

McCown, Brent, Patrick Coyne, Jerry Brown, and Richard P. Murrmann

CHEMICAL INDICATORS OF ARCTIC BIOLOGICAL AND ENVIRONMENTAL ACTIVITIES. *Army Cold Regions Research and Engineering Lab., Hanover, N. H., DA Task 4AO611O1A91DO3, RR-301, 30p., April 1972. 12 refs.*

NTIS, DDC: AD 741797

Two approaches were used to study the carbon cycling in a cold-dominated ecosystem at Barrow, Alaska. One involved a detailed analysis of the flow of carbon dioxide between the atmosphere, soil and biota, and the other concentrated on the internal carbon cycling in plants. A pilot study was also conducted which investigated the possibility of estimating underground plant biomass by biochemical means. Both laboratory and field studies were conducted to analyze the input of CO2 to the arctic atmosphere by frozen tundra soils. Data are presented which indicate that frozen soil is a major source of CO2. It is hypothesized that CO2 trapped in soils during bidirectional freezing in the fall and winter is released during the spring thaw, thus producing a spring rise in the CO2 content of the atmosphere. A procedure for the extraction and estimation of organic nutrients (lipids and carbohydrates) was developed and used to follow the seasonal cycle of these nutrients of plants obtained at Barrow, Alaska. No cycling in levels of carbohydrates (alcohol-soluble) was observed in the foliage during the season, however a definite cycling in lipid levels was seen for all the species studied. The species were synchronous. Plant survival and organic nutrient levels were followed during the winter over a heated-soil experiment at Barrow, Alaska. During the winter, the heating of the soil caused ponding which resulted in the elimination of Dupontia fischeri by mid-winter and the eventual death of all plants by spring. The carbohydrate levels indicated a starvation condition was created where a marked decrease in storage polymers (starch and fructans) occurred without a concurrent large increase in the alcohol-soluble carbohydrate levels. An increase in the fresh/dry weight ratios was also observed indicating etiolated, succulent growth in early winter. Four techniques were tried for estimating the below-ground biomass of plants. Two of these were eliminated as unsuitable, however two other methods (ATP and phospholipid levels) remain to be fully evaluated. (Author abstract)

1971

49211 **APTIC NO. 70899**

Chassaing, P., A. Claria, and F. Sananes

DIFFUSION OF A GAS JET. *(Diffusion d un jet gazeux). Text in French. France, Inst. National Polytechnique de Toulouse, Toulouse (France), 230p., Sept. 1971. 43 refs.*

The diffusion of cylindrical and coaxial turbulent gas jets was studied and applied to industrial stacks and related dispersion phenomena. The behavior of turbulent gas jets in calm and moving atmospheres was investigated theoretically and in model experiments. In wind, the axis of the jet defined as the site of the maximum speeds coincides with the geometric axis calculated on the basis of observations of the flow process. Blown jets used as a means of increasing the lift of the plume have the advantage of providing for better diffusion during the first stage of the diffusion of the jet during which the particular atmospheric stability conditions have little influence on the dispersion processes. The speeded- up dispersion leads to reduced ground-level pollutant concentrations. Also, a depression will be generated at the top of the stack, which promotes and stabilizes the draft. Sutton s and Pasquill s dispersion models and formula for the determination of the plume lift are presented.

49212 **APTIC NO. 71259**

E G and G, Inc., Boulder, Colo., Environmental Services Operation

POTENTIAL ENVIRONMENTAL MODIFICATIONS PRODUCED BY LARGE EVAPORATIVE COOLING TOWERS. *Environmental Protection Agency Contract 14-12-542, Program 16130 DNH 01/71, Water Pollution Control Research Series W72-10548, 82p., Jan. 1971. 12 refs.*

NTIS: PB 210 702; GPO

Techniques for evaluating the extent of plumes from large evaporative cooling towers were developed. Mathematical models were used to describe the dynamics of the wet cooling tower plume and its interaction with the environment. Primary emphasis was placed on predicting the height of the plume. Classical atmosphere diffusion theory was used to determine the downwind spread. The saturation deficit of the atmosphere controls the downward spread of and fogging caused by the plume. Except for cases where the relative humidity approaches 100%, downwind propagation is limited to periods when the air temperature falls below the freezing point. A map of the United States indicating locations of potential adverse atmospheric effects due to cooling towers can be used in conjunction with local data. The computer program is described including input specific specifications. (Author abstract modified)

1956

49213 **APTIC NO. 71201**

Wieland, W.

WATER VAPOR CONDENSATION OF NATURAL AEROSOL AT A LOW DEGREE OF SUPERSATURATION. *(Die Wasserdampfkondensation an natuerlichem Aerosol bei geringen Uebersaettigungen). Z. Angew. Math. Phys., vol. 7:428-460, 1956. 29 refs. Translated from German. Translation Consultants, Ltd., Arlington, Va., 52p. (TR 401-73)*

Laboratory experiments and field measurements were performed to investigate water vapor condensation of natural aerosols at a low degree of supersaturation. The size and activity of the condensation nuclei ran parallel up to a relative humidity of 101%. Aerosol near the ground always contained sufficient active nuclei to form condensation droplets, where the relative humidity of the surrounding medium was 100-101%. Condensation nuclei important for cloud formation were characterized by their size and thus were not separable from the remaining Aitken nuclei as long as a supersaturation boundary was not introduced. Coalescence, as a preparatory process for subsequent condensation in the atmosphere, appeared to be of great significance when the aerosol consisted only of mixed nuclei.

BASIC SCIENCE AND TECHNOLOGY

1975

49214 **APTIC NO. 71501**

Hirose, H., S. Yamanaka, and S. Kawai

PHOTOCHEMICAL REACTIONS IN SULFUR DIOXIDE-LOWER HYDROCARBON-OXYGEN SYSTEMS IN A NITROGEN ATMOSPHERE. *Chemosphere, no. 1:47-54, 1975. 18 refs.*

The photochemical reactions in sulfur dioxide-lower hydrocarbon- oxygen systems in a nitrogen atmosphere were investigated. Aerosol formations during irradiation were observed in both SO2-hydrocarbon and SO2-hydrocarbon-O2 systems. The disappearance rate of SO2 as well as aerosol formations was depressed in all SO2-hydrocarbon-O2 systems with increasing O2 concentrations, while in the SO2-O2 systems the disappearance rate of SO2 increased with added O2. Aerosol formation was promoted and the disappearance rate of SO2 increased by addition of hydrocarbons to the SO2-hydrocarbon systems. In SO2-hydrocarbon systems, the yield of gaseous products increased, while there was no qualitative change with respect to the addition of hydrocarbons.

49215 **APTIC NO. 71183**

Marsh, Edward N., John E. Ritchie, Jr., Ferris B. Benson, and Walter L. Crider

A FACILITY FOR THE EXPOSURE OF HUMANS TO CONTROLLED ENVIRONMENTAL POLLUTANTS. *Computer Sciences Corp., Falls Church, Va. and Environmental Protection Agency, Research Triangle Park, N. C., EPA Contract 68-02-0768, 8p., 1975 (?).*

A facility for determining the effects of environmental pollutants on public health through computer-controlled exposure and clinical evaluation of human subjects is described. Two identical laboratories are under construction, equipped for environmental exposure, and provided with an Air Handling System for recirculating up to 16,000 cu ft/min of air, introducing fresh air, removing particulate matter to nearly clean room conditions, and emergency safety purging. The Pollutant System provides for the delivery, analysis, control, safety monitoring, and calibration of gases and aerosols for the laboratories. The Data Acquisition System utilizes a minicomputer to control and record environmental parameters and to monitor significant operating conditions. (Author abstract modified)

1974

49216 **APTIC NO. 70920**

Bickelhaupt, Roy E.

THE INFLUENCE OF ASH CHEMISTRY ON THE VOLUME CONDUCTION IN FLY ASH. *United States-USSR Working Group, Stationary Source Air Pollution Control Technology, Control Fine-Part. Emiss. Ind. Sources Symp. Proc., San Francisco, Calif., 1974, p. 521-544. 9 refs. (Jan. 15-18, Paper 22.)*

A large number of fly ashes were collected from commercial power stations in the United States and Canada to determine the influence of fly ash chemistry on its resistivity (above 200 C) and hence on its potential for electrostatic precipitation. Resistivity (as a function of temperature) and transference experiments were performed. For a given iron concentration, the resistivity was inversely proportional to the combined lithium and sodium concentrations of the ash. Also, for a constant concentration of lithium and sodium, the resistivity was inversely proportional to the iron concentration. The volume conduction process was controlled by an ionic mechanism in which lithium and sodium were the principal charge carreiers. The iron concentration of the ash influenced the number of lithium and sodium ions capable of mobility, though the mechanism was not established.

49217 **APTIC NO. 70940**

Buckle, E. R. and K. C. Pointon

GROWTH AND SEDIMENTATION IN CADMIUM AEROSOLS. *Atmos. Environ., 8(12):1335-1337, Dec. 1974. 5 refs.*

The growth and sedimentation of newly condensed particles of cadmium were observed in a heat-pulse cloud chamber filled with argon. A supersaturating device was used to first establish an appreciable pressure of metallic vapor in the chamber before the induction of particle nucleation by condensation. Both faint particles that remained in suspension and bright particles that descended at appreciable speeds were observed. The Airy patterns of the bright particles became dimmer as their speed of descent became slower, giving the impression of evaporation. However, when fresh argon was admitted and the condensation brought about rapidly to avoid the buildeup of cadmium vapor in the chamber, the brightness and speed of descent remained constant. This effect was not visible in clouds condensed at higher temperatures (above room temperature). Scanning electron microscopic studies of the fall-out indicated that the fading of the Airy discs observed in the chamber studies corresponded to a progressive roughening of the surface by growth in the vapor. At temperatures above ambient, the bright spherical particles tended to be smooth. Errors in the sizing of aerosols by measurement of the terminal velocity are likely to be complicated by the continual growth that occurs under volatile conditions.

49218 **APTIC NO. 70441**

Chu, Richard R., and Clyde Orr, Jr.

PARTICULATE PRODUCTS FROM PHOTOCHEMICAL OXIDATION OF ORGANIC VAPORS IN AIR. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 27p., 1974. 28 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 9-13, 1974, Paper 74-156.)*

Submicron aerocolloids were produced by ultraviolet irradiation from trace hydrocarbons in air. Photochemical reaction rates for cyclohexene, benzene, toluene, and o-xylene separately in air were determined at ppm level by a photochemical smog chamber method. Final products included large amounts of aliphatic aldehydes and highly oxygenated particulates consisting of approximately more than half (63-81%) of the reacted carbon atoms. Infrared, mass spectrometric, and other analytical methods consistently indicated that carbonyl and hydroxyl groups were predominant and characteristic components of the products. The early onset of particulate formation and the particulate production was much enhanced by the presence and participation of nitrogen oxides or water vapor. Aerosol products were sampled and collected by ultrafine filters, thermal precipitators, and electrostatic precipitators. Microphysical properties were observed by electron microscopy. (Author abstract modified)

49219 **APTIC NO. 70433**

Deuel, C. L. and R. M. Roberts

DEVELOPMENT OF SAMPLING DEVICES FOR GASEOUS ATMOSPHERIC TRACERS (FINAL REPORT). *Analytical Research Labs., Inc., Monrovia, Calif., Environmental Protection Agency Contract 68-02-1235, ROAP 26AA1, Program Element 1AA003, Rept. EPA-650/ 4-74-050, ARL Rept. 2601-F, 63p., July 1974. 3 refs.*

NTIS: PB 238921/AS

The development and testing of an air sampler to be used to collect tracer compounds over protracted periods and to facilitate the measurement of atmospheric tracer compounds released in meteorological diffusion studies are discussed. Tests were conducted to determine the adsorptive capacity of various sorbents potentially suitable for collecting such electronegative tracer compounds as sulfur hexafluoride and trifluoromethylsulfur pentafluoride. A field-practical sampler, incorporating the best sorbent found, a high surface- area coconut charcoal, was then designed and subjected to laboratory tests. The effects on sampler performance of various atmospheric influences, such as composition, pollutants, temperature, and tracer loading and level were determined. Desorption techniques allowing quantitation of the tracer were developed. (Author abstract)

49220 **APTIC NO. 70969**

Fujii, T., K. Imamura, Y. Mizoguchi, M. Fukuyoshi, T. Nogi, and N. Naito

STUDIES ON DETERMINATION OF HYDROCARBONS IN THE AMBIENT AIR. *(Taiki-chu no tanka suiso ni kansuru kenkyu. Dai-4-ho sekiyukei nenryo no tanka suiso ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):209, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 66.)*

To investigate hydrocarbon pollution due to evaporation from fuel storage tanks, the evaporation rate of 10 fuel oils was measured by placing a sample oil in beaker and weighing it before and after a period of time. The evaporation rate decreased in the order of gasoline, naphtha, crude oil, heavy oil, kerosene, and light oil, with a range of 0.1-74.3 mg/hr/sq cm/100g. The component analysis of fuel oil and vapor by gas chromatographic and mass analyses indicated that the ratio of saturated and unsaturated HC in the vapors increased due to an increase of low boiling point components, while that of aromatic HC decreased. Unsaturated HCs (C4-C7) were absent in naphtha; however, considerable amounts (19.4-43.6%) were found in gasoline and crude oil vapor.

49221 **APTIC NO. 70443**

Garvin, David and R. F. Hampson

CHEMICAL KINETICS DATA SURVEY VII. TABLES OF RATE AND PHOTOCHEMICAL DATA FOR MODELING OF THE STRATOSPHERE (REVISED). *National Bureau of Standards, Washington, D. C., Dept. of Commerce, Dept. of Transportation Contract, Rept. NBSIR 74-430, 105p., Jan. 1974. 336 refs.*

NTIS: COM-74-10724

Tables of reaction rate constants and photochemical data for gas phase reactions pertinent to stratospheric chemistry are presented. The data are grouped according to chemical reactions of neutral species, vibrational energy transfer processes, high temperature air reactions, and ion-molecule reactions. Reactants considered include: ozone, oxygen, hydrogen, nitrogen compounds (including nitrogen oxides), sulfur oxides, aldehydes, peroxides, carbon dioxide, hydrocarbons, and water. Bibliographies for each set of tables are provided along with comments that refer the user back to the original monograph from which the tables were extracted.

49222 **APTIC NO. 71179**

Haring, H. G.

VAPOR PRESSURES AND RAOULT'S LAW. DEVIATIONS IN RELATION TO ODOR ENHANCEMENT AND SUPPRESSION. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.) New York, Academic Press, 1974, p. 199- 226. 8 refs.*

Experimental findings demonstrating deviations from Raoult's law in relation to odor enhancement and suppression are described. The vapor pressure of a volatile component in an odorant mixture is in most cases higher than that predicted from the composition of the liquid mixture by Raoult's law because of mutual interactions between the components in the odorant mixture. Since the composition of an odorant mixture is subject to continuous change due to evaporation of the volatile components, the odor intensity as well as the odor quality of the mixture may be completely altered. Psychophysical effects can also cause observed odor intensities to deviate from those calculated from physicochemical data. A gas chromatographic method for accurately determining vapor pressures is also described. A steel gas sampling valve, a modification of the Holm-Jensen air sampling pipette, is used to achieve reliable gas sampling.

49223 **APTIC NO. 71008**

Hashimoto, Moriyashi and Kuniyuki Kitabayashi

EVALUATION OF BERGLUND-LIU MONODISPERSE AEROSOL GENERATOR. *(Berglund-Liu tanbunsan earozoru hassei sochi). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):245, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 105.)*

The stability of the Berglund-Liu aerosol generator is examined using methylene blue and uranine in ethyl alcohol-water (one to four) solution. The size distribution, shape, and size of generated particles are studied by an electron microscope, and the concentration stability of the particles is studied by a digital dust indicator. The distribution of particle sizes was 2.5 micron to 5 micron with average particle size of 3.75 micron which was in close agreement with the theoretically calculated value, 3.91 micron. The standard deviation was 1.13 and the particles generated were of globular form. The stability of concentration was + or - 5%. Therefore the generator generated stable aerosol, however instability of aerosol was caused by the drying process after the particle generation.

49224 **APTIC NO. 70407**

Hedley, W. H., S. M. Mehta, C. M. Moscowitz, A. D. Snyder, H. H. S. Yu, and D. L. Zanders

SOURCES AND CHARACTERIZATION OF FINE PARTICULATE TEST DUSTS (FINAL REPORT). *Monsanto Research Corp., Dayton, Ohio, Environmental Protection Agency Contract 68-02-1320, Task 8, Program Element 1ABO12, EPA-650/2-74-117, ROAP 21ADM-021, MRC-DA-431, 107p., Nov. 1974. 47 refs.*

NTIS: PB 238 924/AS

Suitable characterization criteria for test dusts were developed to determine procedures for obtaining, handling, and characterizing the dusts and to establish potential suppliers of test dusts. Seventeen criteria were identified: size distribution; shape, surface area, and pore volume; chemical composition; density; wettability and moisture content; solubility; hardness, abrasiveness, and grindability; charge properties; dielectric properties; corrosiveness; optical properties; magnetic susceptibility; carrier gas composition; and solids loading. Potential industrial suppliers of test dusts for simulation purposes were identified for 11 industries: pulverized coal combustion, stoker-fired coal combustion, basic oxygen furnaces, open hearth furnaces, electric arc furnaces, metallurgical coke ovens, cement plants, municipal incineration, steel foundries, Kraft pulp mill recovery furnaces, and asphalt plants. The production of a particulate-laden test flue gas was evaluated. Redispersion of collected dusts is favored over generation of fresh particulate. (Author abstract modified)

49225 **APTIC NO. 71106**

Hiroyasu, Hiroyuki, Toshikazu Kadota, and Yuso Yokoyama

PENETRATION OF FUEL SPRAY IN DIESEL ENGINES. *(Dizeru kikan no funmu no totatsu kyori ni kansuru kenkyu). Text in Japanese. Hiroshima Daigaku Kogakubu Kenyu Hokoku (Bull. Fac. Eng., Hiroshima Univ.), 23(1):55-63, 1974. 9 refs.*

To obtain basic information for effective designing of diesel engine combustion chambers and for low pollutant emission combustion study, the dispersion of fuel spray was investigated by measuring the penetration of fuel spray, air entrainment, and spray angle. Using a compressed gas chamber, the penetration of fuel spray was photographed at the rate of 3000 frame/sec by varying the nozzle type, pump speed, rack position and back pressure. Simultaneously, the pressure variation at the injection nozzle was measured by a semiconductor strain gauge attached to the inlet connector of the nozzle holder. The air entrainment was photographed using petroleum vapor as tracer, and the relationships between flow rate and back pressure and pump speed and rack position were investigated. The spray angle was measured from high speed photographs. Based on experimental results, the empirical equations for penetration of fuel spray within five msec after injection, spray angle, and flow rate of air entrainment were obtained.

49226 **APTIC NO. 71384**

Lyshkow, Norman A.

GAS PERMEATOR. *(Combustion Equipment Associates, Inc., New York) U. S. Pat. 3,824,836. 6p., July 23, 1974. 3 refs. (Appl. Nov. 21, 1972, 19 claims).*

An improved method and apparatus for use in the calibration of gas analytical instruments are described. Instruments for use in the measurement of pollutant gases must be calibrated by using a standard gas stream containing a known quantity of pollutant gas mixed with a gas inert to the analytical system of the instrument. A permeator assembly is described for supplying the pollutant and inert gases. The assembly has a more uniform rate of diffusion than a conventional closed Teflon tube. The assembly is completely portable and, unlike a Teflon tube, it can be used under varying ambient temperature conditions and can provide a uniform mixture of the pollutant and inert gases.

49227 **APTIC NO. 71414**

Nakatani, S. and T. Tsunoda

THE RELATION BETWEEN AIR CONDUCTIVITY AND AEROSOLS. *(Taiki biryushi osen to taiki denki dendodo tono kanren ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):241, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 101.)*

Air pollution, as a function of the size and concentration of airborne particulates, was examined by measuring the electrical conductivity of the air. As particulate size (diameter) increases, the number of particles decreases. Electrical conductivity and ion lifetime showed better correlation than electrical conductivity and particle concentration. Therefore, ion lifetime is probably a function of particle size (average diameter) as well as particulate concentration. Atmospheric electrical conductivity over land was 1/5 of that found over the Pacific Ocean (Cobbs and Wells, 1970), and is indicative of the extent of pollution.

49228 **APTIC NO. 71009**

Ogikubo, T., S. Abe, and H. Koyama

ON THE STANDARD PARTICLE GENERATOR OF STEARIC ACID. *(Sutearinsan hyojun ryushi hassei sochi ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):244, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 104.)*

A modified form of the Sinclair-LaMer aerosol generator is developed to generate standard stearic acid particles. The main modification is the employment of a number of 2 mm capillary tubes in the acid vapor and nitrogen stream, which were isolated from outside and controlled the particle size. The capillary tubes are heated to prevent the condensation of acid vapor as well as to reevaporate the larger particles condensed within the tubes. By adjusting both nitrogen flow (1.0-5.0 l/min) and heating temperature (120-150 C), various stearic acid particles are obtained in relatively uniform sizes, 0.25 micron to 1 micron. The aerosol concentration of stearic acid was fairly constant with the nitrogen flow rate, and changed with tube temperature. The concentration range obtained was 25-400 mg/cu m with good reproducibility.

49229 **APTIC NO. 71317**

Ootsuka, Y. and S. Miyazaki

EFFECT OF BEND ON DUST CONCENTRATION IN STACK GAS. *(Baien nodo ni oyobosu kyoku kanbu no eikyo (dai 1-ho) 90 deg bendo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):425, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 276.)*

Air at 12.5 m/sec was introduced into a 155 mm inside diameter flue model and 50 g of fly ash was fed at 5-10 g/min with the aid of a vibrational feeder. The mixed gases were passed through a 90 degree bent tube to a horizontal and a vertical measurement tube. Gases were sampled at 9 locations and analyzed. At 20 degrees and RH 50%, no change of ash concentration was observed with time of ash supply. The effect of adsorption of ash on the inside wall of the flue and on sampling tubes was negligible. A higher ash concentration was found near the inside wall than at the center of the flue. This was particularly true as the sampling position was moved closer to the bent tube.

49230 **APTIC NO. 71043**

Otaki, Atsuchi, Kiyoshige Shiozawa, Shinichi Okamoto, and Jun Hiroo

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION, PART IX. *(Taiki osen nodo yosoku ni kansuru kenkyu, IX). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):278, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 134.)*

An anticipated air pollution level in Chiba prefecture is calculated and compared with the pollution level observed at fourteen stations. Fourier transformation is done for each term in a basic equation for the calculation, and necessary variables are estimated from previously collected pollution data in the area. The standard deviation of the error between the calculated and observed level for the 6-hour forecast was 0.8 pphm and linearly increased with longer forecasting hours. For a 24-hour forecast, the error was 1.5 pphm. More data gathered over a longer period of time is needed to minimize the forecasting error in the equation variables.

49231 **APTIC NO. 71172**

Sandorfy, C.

ANNUAL PROGRESS REPORT FOR SEPTEMBER 1973-SEPTEMBER 1974 ON WORK CARRIED OUT UNDER AGREEMENT WITH THE MANUFACTURING CHEMISTS ASSOCIATION. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 464, Dec. 11-12, 1974. 6 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

Research studies on spectroscopy and photochemical changes of fluorocarbons are reported. The vacuum ultraviolet absorption and photoelectron spectra of all the industrially important fluorocarbons were measured. Future plans include studying photochemical changes occurring under ultraviolet radiation and reactions between fluorocarbons and ozone which occur under the influence of far ultraviolet radiation at different altitudes.

49232 **APTIC NO. 71002**

Shoji, Hikaru and Tsuneo Tsukatani

SPECTRUM ANALYSIS OF AIR POLLUTANT CONCENTRATION AND ITS APPLICATION. *(Taiki osen nodo no supekutoru kaiseke to oyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):273, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 131.)*

A theoretical equation to predict the percentile distribution of sulfur oxides levels is proposed. The calculated percentile distribution using the equation is compared with plots of SOx data collected in Tokyo and Yokkaichi in 1967 through 1971. Percentile distribution is calculated for up to 3-month periods. The obtained theoretical curves for each percentile distribution versus time period were in good agreement with the observed values.

49233 **APTIC NO. 71426**

Tanada, Seiki and Keito Boki

PROPERTIES OF VARIOUS ADSORBENTS FOR REMOVAL OF HYDROGEN SULFIDE GAS. *Chem. Pharm. Bull., 22(11):2703-2709, 1974. 18 refs.*

The adsorption of hydrogen sulfide gas on 30 different adsorbents (10 silicate, 10 active carbon, and 10 zeolite) was measured gravimetrically to find the most suitable adsorbent for H2S removal via dry process. A synthetic zeolite showed the largest amount of adsorption (102.35 mg/g). Silicate adsorbents showed adsorptions as high as 23.65 mg/g, and active carbon adsorbents showed adsorptions as high as 38.75 mg/g. The amount of H2S adsorbed per unit surface area appeared to be independent of surface pH and adsorption isotherms. Except for activated carbon, the porous structure of the adsorbents mainly determined the adsorption of the gas per unit surface area. The adsorbed H2S appeared to be partially reduced to sulfur on the surfaces of the adsorbents.

49234 **APTIC NO. 71504**

Thomas, Jess W.

AEROSOL SIZE DISTRIBUTION FROM ELUTRIATOR EFFICIENCY MEASUREMENTS. *J. Aerosol Sci., vol. 5:583-587, 1974. 9 refs.*

A method for obtaining approximate cumulative aerosol size distributions with high flow rate elutriators is described. Three multiple channel elutriators of different capacities (different cut-off sizes) were used to sample the aerosol simultaneously and in parallel. A mixture of monodisperse aerosols was found analytically from the measured efficiencies, yielding the efficiencies for each elutriator. The cumulative size distribution was inferred from the composition of the monodisperse aerosol mixture. The method was tested theoretically by assuming an aerosol with a given size distribution, calculating the efficiencies of three given elutriators for that aerosol, and determining how accurately the particle size distribution of the original aerosol was regenerated by application of the method. A computer program was set up to arbitrarily choose several hundred different combinations of cutoff particle settling velocity, calculate the efficiencies, and solve for the particle size fractions. Application of the method to three log-normal aerosols and a non log-normal aerosol with size fractions between 0.82 and 6.91 micron showed reasonably good agreement with actual size distributions.

49235 **APTIC NO. 70829**

Trolinger, J. D., H. T. Bentley, A. E. Lennert, and R. E. Sowls

APPLICATION OF ELECTRO-OPTICAL TECHNIQUE IN DIESEL ENGINE RESEARCH. *Preprint, Society of Automotive Engineers, New York, 13p., 1974. 14 refs. (Presented at the Society of Automotive Engineers Automotive Engineering Congress, Detroit, Mich., Feb. 25-March 1, 1974, Paper 740125.)*

Studies on a two-cycle, three-cylinder diesel engine modified by installing quartz windows in the combustion chamber were performed to investigate the feasibility of applying electro-optical techniques in diesel engine research. Techniques investigated included photography, holography, laser resonance absorption spectroscopy, and laser velocimetry. Droplet formation, breakup, and combustion were three-dimensionally observed in the combustion chamber using holography. The same hologram can be used for particle sizing and flow visualization studies. Formation of hydrocarbons was observed in real time with resonance absorpton, using a tunable helium-neon laser. Laser velocimetry gave components of air velocity in the combustion chamber of the diesel engine. High-speed photography permitted the observation of fuel spray distribution, the position, time, and progagation of the combustion, smoke formation, and, to some degree, turbulence.

49236 **APTIC NO. 71191**

Organisation for Economic Cooperation and Development, Paris (France), Environment Committee

MERCURY AND THE ENVIRONMENT: STUDIES OF MERCURY USE, EMISSION, BIOLOGICAL IMPACT AND CONTROL. *194p., 1974. 211 refs.*

The environmental and socio-economic impacts of mercury usage and control are reviewed. Topics covered include: industrial and non-industrial sources of mercury; technical alternatives to mercury use; methods of controlling mercury use (market mechanisms, legislation, emission standards); the monitoring and surveillance of mercury; economic and technical aspects of mercury control; the biological impact of mercury (plants, animals, and man); and conclusions and recommendations of the Organization for Economic Cooperation and Development concerning mercury. Regarding airborne mercury, levels of 0.019 micrograms/cu m can be found in urban areas (Chicago) as compared with 0.001 microgram/cu m over oceans and 0.001-0.009 microgram/cu m over non-mineralized land areas. High amounts are also found in industrial areas (roasting of sulfide ores, cement production, and fossil fuel combustion), near agricultural areas where organic mercury-treated seed is sown, near areas where sludge is disposed or spread as fertilizer, and near volcanic areas. Considering the volume of air inhaled per day by an average person, the amounts of mercury absorbed from the atmosphere range from 0.01-0.10 microgram and do not appear to pose a human health hazard.

1973

49237 **APTIC NO. 70827**

Fish, B. R. and W. H. Wilkie

THE FLUID DYNAMICS OF A SPHERICAL PARTICLE: TABULATION OF SETTLING VELOCITY, REYNOLDS NUMBER, DRAG COEFFICIENT, RELAXATION TIME, AND ACCELERATION-DISTANCE IN AIR AND WATER. *Oak Ridge National Lab., Oak Ridge, Tenn., Health Physics, Div., Scandia Corp Contact 48-5377, 171p., Nov. 1973. 35 refs.*

NTIS: ORNL-TM-4100

Various fluid dynamical parameters are calculated for spherical particles falling freely in air and water. Tables of values for settling velocity, Reynolds number, drag coefficient, relaxation time, and acceleration-distance are provided for particles from 1-1000 micron in diameter with a buoyancy-corrected density of 1-12 g/cc falling freely in air at 20 C and 760 mm mercury pressure and in water at 20 C. Curves are illustrated which can be used to determine stop-distance for a sphere acted upon by fluid dynamical forces only. Errors associated with the values tabulated should be less than 2%, with the possible exception of the relaxation times and stop-distances for Reynolds numbers above several hundred. In this region the tabulated values are too low for conditions of acceleration; however, this discrepancy probably does not exceed about 10% for Reynolds numbers of 1000.

49238 **APTIC NO. 71154**

Hardesty, D. R. and F. J. Weinberg

ELECTRICAL CONTROL OF PARTICULATE POLLLUTANTS FROM FLAMES. *Combustion Inst., Pittsburgh, Pa., Proc. Int. Symp. Combust., 14th, University Park, Pa., 1972, p. 907-918, 1973. 2 refs. (Aug. 20-25.)*

Following the demonstration that growth and deposition of flame carbon can be controlled by applied electric fields, this principle was extended to particulate pollutants from flames in general. The aim of the study was to use suitable field configurations to cause the free charges produced during chemi-ionization to attach to particles, even in the absence of any other spontaneous charging mechanism. The abundance of chemi-ions in hydrocarbon flames, prevented from recombination by the applied field, replaces the corona discharge of electrostatic precipitation which wastes power. The optimum charging conditions were investigated theoretically. Since the trajectories in fields of particles of known size and charge (and hence, mobility) are accurately predictable, these parameters were measured experimentally. In addition to drawing on previous results for flame carbon, particles of silica from hexamethyl disiloxane and the products of tetraethyl lead, both injected into premixed methane/air flames, were studied. Allowing for the difference that, unlike carbon, these particles cannot be burned up, their behavior was generally similar. In particular, their deposition in fields and decrease in particle size, brought about by field-induced shortening of residence times, allowed a similar degree of electrical control to be exercised. In the case of lead oxide, difficulties arose when the flame temperature exceeded its low boiling point, because it was then present as a vapor in the zone in which charges usually attach. This led to the proposal and testing of an alternative system in which a second flame was used as an ion source in a cooler part of the product stream. This may prove to be of practical use, particularly where a second-stage flame is used to combat incomplete combustion. The theory of charge acquisition is generalized to allow prediction of performance and optimization of design. (Author abstract)

49239 **APTIC NO. 70432**

Sehmel, G. A., S. L. Sutter, and M. T. Dana

DRY DEPOSITION PROCESSES. *In: Pacific Northwest Laboratory. Annual Report for 1972. To the USAEC Division of Biomedical and Environmental Research. Vol. II. Physical Sciences. Part I. Atmospheric Sciences. Battelle Memorial Inst., Richland, Wash., Pacific Northwest Lab., p. 43-49, April 1973. 4 refs.*

NTIS: BNWL-1751 PT1

A predictive model for deposition velocities was developed to describe isothermal particle deposition to flat surfaces when gravity was assisting, opposing, or not influencing deposition. To determine the effect of surface roughness on deposition, experimental deposition velocities were determined over gravel surfaces. Comparisons in deposition velocities were made for a flat surface, a gravel surface, and an artificial grass surface. For the grass surface, the results of a field experiment showed that deposition velocities obtained in the laboratory in wind tunnel tests could be applied to similar surfaces in the open atmosphere. (Author abstract modified)

49240 **APTIC NO. 70440**

Stuhl, F.

RATE CONSTANT FOR THE REACTION OF OH WITH N-C4H10. *Z. Naturforsch., vol. 28:1383-1384, 1973. 7 refs.*

The kinetic behavior of hydroxyl radicals was studied in the presence of a large excess of n-butane. Hydroxyl radicals were produced by pulsed vacuum ultraviolet photolysis of water and were monitored directly by a resonance fluorescence method. The rate constant for the reaction hydroxyl radical plus n-butane was 2.35 + or - 0.35 times 10 to the -12th cu cm/molecule/sec at 298 K. (Author abstract)

1971

49241 **APTIC NO. 71203**

Shuvalov, V. A. and A. A. Krasnovskiy

LUMINESCENCE OF ZINC-PORPHYRINS IN MICROORGANISMS AND PLANTS: PHOSPHORESCENCE AND DELAYED FLUORESCENCE. *(Lyuminestsentsiya tsink profirinov v mikroorganizmakh i rasteniyakh: fosforestsentsiya i zamedlennaya fluorestsentsiya). Mol. Biol., 5(5):698-710, 1971. 18 refs. Translated from Russian. Scientific Translation Service, Santa Barbara, Calif., 19p. (TR 469-73)*

The luminescent properties of porphyrins and their zinc complexes in cells of various organisms without specialized photochemical systems were studied with a phosphoroscope designed to record the excitation spectra and kinetics of afterglow quenching. The afterglow of yeast cells was in the red region of the spectrum at 20 degrees with a lifetime of 5000 sec. Afterglow was sharply increased when the cells were incubated in a phosphate buffer with the addition of zinc ions. The excitation spectrum of afterglow was coincident with the absorption spectrum of afterglow was coincident with the absorption spectrum of zinc- porphyrin present in the cell. Luminescence at 20 degrees was delayed fluorescence of zinc porphyrin while that at minus 196 degrees was phosphorescence. Delayed fluorescence was effectively quenched by oxygen. Anaerobic conditions around the radiant molecule were the result of cellular respiration, with the concentration of oxygen not exceeding 5 times 10 to the -7 M. Yeast cells incubated in a sucrose solution without zinc ions accumulated protoporphyrin which also had a delayed fluorescence. Delayed luminescence of metal porphyrins was also found in cells of aerobic bacteria, photosynthetic bacteria, etiolated leaves of corn, and mitochondria extracted from the liver of rats.

EFFECTS-HUMAN HEALTH

1975

49242 **APTIC NO. 71122**

Cooper, P.

MORE DETAILS ON NITROGEN DIOXIDE INHALATION. *Food Cosmet. Toxicol. (London), 13(1):135-139, Feb. 1975. 23 refs.*

Numerous animal-exposure studies are cited in a toxicological review of the effects of inhaled nitrogen dioxide. Pulmonary changes observed in rats exposed to 17 ppm NO2 for up to 43 days included enlarged lungs, alveolar engorgement, loss of cilia from the epithelial cells, sloughing of type I pneumocytes, and thickening of the air-blood barrier with repair cells of a low cuboidal type. Exposures to 2 ppm NO2 for up to 12 months resulted in hypertrophy of ciliated cells of the terminal bronchioles, with swelling and disappearance of many cilia being observed. Cilia reappeared by the 14th day, though in reduced numbers. Studies of the recovery process in rats exposed to various levels of NO2 revealed a large increase in the number of type 2 cells (cuboidal vacuolated cells lying on the alveolar surface) taking up tritiated thymidine label. These type 2 cells divided into sister cells which in turn were transformed into type 1 cells for the renewal of alveolar epithelium. Mucociliary clearance studies of rats exposed to 6 ppm NO2 for 6 weeks showed depressed ciliary function which was reversible within 7 days. Mice exposed to aerosols of Staphylococcus aureus and to either 7 ppm NO2 after or 2.3 ppm NO2 before infection displayed adversely affected intrapulmonary bactericidal defence mechanisms, suggesting that human populations exposed to traces of NO2 may incur an increased risk of pulmonary infection. Acute toxicity studies with various laboratory animals demonstrated that mortality from NO2 exposure was increased by exercise or cold stress, adrenalectomy, or high ambient carbon dioxide levels.

49243 **APTIC NO. 71186**

Creason, John P., Thomas A. Hinners, Joseph E. Bumgarner, and Cecil Pinkerton

TRACE ELEMENTS IN HAIR RELATED TO EXPOSURE IN METROPOLITAN NEW YORK. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Human Studies Lab., 43p., 1975. 80 refs.*

The use of scalp hair was evaluated in environmental monitoring of humans for exposure to certain trace elements. Significant correlations are reported within a single metropolitan area between trace-element content of hair and exposure (as measured by analyses for the corresponding elements in dust fall or house dust) for barium, chromium, lead, mercury, nickel, tin and vanadium. Age, sex, hair color, and smoking habits were factors included in the statistical evaluation. Several metals increase and decrease together in the hair specimens, in agreement with trends reported for other human tissues. (Author abstract modified)

49244 **APTIC NO. 71034**

Farkas, Walter R.

THE EFFECTS OF PLUMBOUS ION ON PROTEIN BIOSYNTHESIS IN RETICULOCYTES. *Res. Commun. Chem. Pathol. Pharmacol., 10(1):127-148, Jan. 1975. 28 refs.*

The effect of lead on the biosynthesis of hemoglobin and nonheme protein in rabbits was examined along with amino acid transport into rabbit reticulocytes. The effects of lead on protein biosynthesis by a leukemic line of white blood cells, HeLa cells, and Escherichia coli were also studied. Most of the rabbit reticulocytes assayed were not affected by plumbous ion concentrations of 1.0-3.0 micromoles, although 100 micromoles of lead caused complete inhibition of protein biosynthesis in these reticulocytes. Intact cells were considerably more sensitive to lead than cell-free protein synthesizing systems. E. coli, Hela, and leukemic white blood cells were not inhibited at 100 micromoles of lead. This concentration, however, caused a 78% stimulation in protein biosynthesis of the leukemic leukocytes. Lead also inhibited the synthesis of non-heme protein in reticulocytes; this effect was not observed in any of the other cells tested. Alpha chain synthesis was inhibited to a greater degree than beta chain synthesis in rabbit reticulocytes. Lead did not significantly affect the transport of amino acids into reticulocytes.

49245 **APTIC NO. 70362**

Kagawa, Jun and Toshio Toyama

EFFECTS OF OZONE AND RIEF EXERCISE ON SPECIFIC AIRWAY CONDUCTANCE IN MAN. *Arch. Environ. Health, 30(1):36-39, Jan. 1975. 7 refs.*

The effects of ozone exposure (9 ppm) and/or pedaling exercise on specific airway conductance were studied in four healthy male volunteers (ages 20-25 yr, 1 smoker and 3 nonsmokers). Specific airway conductance (calculated from measurements of airway resistance and volume of thoracic gas) increased during exercise alone, amounting to a 6.7% mean increase. Ozone inhalation (5 min) without exercise resulted in a decrease in the specific airway conductance of about 5.0% (mean) of the control value during the exposure episode. Specific airway conductance returned to normal after a recovery period of about 15 min. Ozone exposure plus exercise resulted in a decrease of 3.2% of the specific airway conductance during the episode and a 13.4% decrease 5 min after the episode. After a 30-minute recovery period, a decrease of 4.5% of the specific airway conductance was still noted. Ozone at 0.9 ppm thus appears to have adverse effects on respiratory functions when administered in conjunction with exercise.

49246 **APTIC NO. 71327**

Koizumi, A.

ECOLOGY AND ENVIRONMENTAL HEALTH. *(Ekorojii to kankyo hoken). Text in Japanese. Ao to Midori (Blue Green), 4(1):38-43, Dec. 1974/Jan. 1975.*

The ecological life cycle of plants, animals, and soil microorganisms is discussed in terms of anthropagenic alterations of nature. The development of science and technology has resulted in an artificial imbalance of potentially harmful compounds in nature and these pollutants are being increasingly incorporated into the entire ecological scheme. Environmental pollutants are described with reference to their health hazards.

49247 **APTIC NO. 70733**

Maekawa, S.

THE FORMIDALE STATUS QUO OF HEALTH DISTURANCE - THE RESULTS OF DAMAGE SURVEY ALONG TOMEI HIGH SPEED MOTOR ROAD. *(Osorubeki kenko hakai no jittai - Tomei kosokudoro ensen ni miru higai chosa). Text in Japanese. Keizai Hyoron (Econ. Rev.), 24(2): 82-93, Feb. 1975.*

There was a surprising miscalculation in planning the To-mei High Speed Motor Road. The actual motor traffic is two to three times greater than expected. The damage by the increase of noise, vibration, and air pollution caused by such increased motor traffic continuously and increasingly afflict the inhabitants who live along the road. According to a survey in 1973 on the inhabitants of two collective housing areas along the road, the increase of respiratory diseases, especially acute and chronic rhinitis was noticeable, possibly due to air pollution caused by auto exhaust. The increased tendency to catch cold, and the tendency of difficulty in curing sickness are sufficient evidence of air pollution damage caused by increased motor traffic on the road.

49248 **APTIC NO. 71028**

Miller, Albert, Arthur M. Langer, Alvin S. Teirstein, and Irving J. Selikoff

NONSPECIFIC INTERSTITIAL PULMONARY FIBROSIS. ASSOCIATION WITH ASBESTOS FIBERS DETECTED BY ELECTRON MICROSCOPY. *New Engl. J. Med., 292(2):91-93, Jan. 9, 1975. 15 refs.*

An association between nonspecific interstitial pulmonary fibrosis and asbestos fibers detected in lung tissue with electron microscopy is demonstrated for a 63-year-old male presenting with symptoms of breathlessness. Although a lung tissue biopsy suggested interstitial inflammation and fibrosis, light microscopic examination failed to reveal mineral particles or asbestos bodies. Electron microscopy, however, revealed ubiquitous fibrils of chrysotile asbestos, averaging 27.5 nm in width and less than 100 nm in length. The patient had no history of exposure to pathogenic dusts. Thus, the association of submicroscopical chrysotile fibrils with severe pulmonary fibrosis, in the absence of fibers demonstrable by light microscopy, is shown. Other cases diagnosed as usual interstitial pneumonia, fibrosing alveolitis, or idiopathic pulmonary fibrosis may also prove to be pneumonconioses by yielding evidence of mineral dusts upon electron microscopic examination.

49249 **APTIC NO. 71326**

Ota, H. and T. Katase

POLLUTION BY PHTHALIC ESTERS AND THE STATUS QUO OF RESEARCH IN JAPAN: EFFECTS ON LABORATORY ANIMALS AND THE STATUS QUO OF ENVIRONMENTAL POLLUTION. *(Futarusan esuteru osen to nihon no kenkyu jokyo). Text in Japanese. Kagaku (Science), 45(3):182-183, March 1975. 40 refs.*

The effects of phthalic acid esters on laboratory animals by oral administration such as growth inhibition, inhibition of pregnancy, and teratogenecity, as well as the histopathological alterations are described. Environmental pollution by phthalic acid esters such as di-2-diethylhexyl phthalate and dibutyl phthalate is discussed. The average content of both phthalic acid esters in air was 0.69 microgram/cu m, determined by continuous sampling for 2 days.

49250 **APTIC NO. 71086**

Petajan, J. H., K. J. Voorhees, S. C. Packham, R. C. Baldwin, I. N. Einhorn, M. L. Grunnet, B. G. Dinger, and M. M. Birky

EXTREME TOXICITY FROM COMBUSTION PRODUCTS OF A FIRE-RETARDED POLYURETHANE FOAM. *Science, vol. 187:742-744, Feb. 28, 1975. 10 refs.*

Rats were exposed to smoke from the nonflaming combustion of Douglas fir wood, an untreated polyurethane foam, and a polyurethane foam treated with the fire retardant O,O-diethyl-N,N-bis-(2-hydroxyethyl)-aminomethyl phosphonate. Inhalation of wood smoke (5 g wood) resulted in severe respiratory distress and a moderate elevation of carboxyhemoglobin (30-46%). Essential gross pathological changes were confined to the lungs. Responses of animals exposed to smoke from the untreated polyurethane foam were those expected from the mild to moderate COHb elevation (28-33%) observed. Unloading of carbon monoxide was normal, and there was no evidence of respiratory distress. Postmortem examination revealed normal lungs and no evidence or respiratory irritation. Animals exposed to polyurethane foam treated with either 4 or 8% of the phosphate flame retardant showed varying degrees of seizures. All animals exposed to smoke from the polyurethane foam treated with 8% retardant showed myoclonic jerks which progressed to status epilepticus and death. The toxic combustion product responsible for the seizures was identified as the bicyclic phosphate, 4-ethyl-1-phospha-2,6,7- trioxabicyclo(2.2.2.)octane-1-oxide.

49251 **APTIC NO. 71038**

Stokinger, Herbert E.

USEFULNESS OF BIOLOGIC AND AIR STANDARDS FOR LEAD. *J. Occup. Med., 17(2):108-112, Feb. 1975. 12 refs.*

The usefulness of biological indicators in addition to airborne lead monitoring is discussed in relation to controlling occupational lead exposure. Measurement of airborne lead in occupational situations involving intermittent exposure, peculiarities of work habits, and percutaneous absorption is not by itself a reliable index of exposure; hence, the need for biological indicators. Measurements of blood lead and erythrocyte delta-aminolevulinic acid dehydrase are the indicators of choice for subthreshold exposures to inorganic lead, while blood lead and urinary delta-aminolevulinic acid measurements are useful above the threshold limit value. Urinary lead determinations provide the best indication of exposure to organic lead compounds. Air monitoring for lead is necessary to insure control of the entire working environment rather than just the worker himself.

49252 **APTIC NO. 70735**

Suzuki, T.

INDUSTRY AND ENVIRONMENTAL PROLEMS FROM NOW ON (3) - CHAPTER I. ENVIRONMENT AND HEALTH. *(Korekarano sangyo to kankyo mondai (3) - I. kankyo to kenko). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 11(1):24-34, Jan. 1975.*

A historical description is given on human health and environmental problems. Environmental problems include external, internal, and psycho-social problems interrelating around the homeostasis of living things, in this case, mankind. The problem of nitrogen dioxide and infantile asthma is described as an example. The external environment is further divided into technosphere and biosphere, the latter surrounding the former. The treatment of pollutants between the two spheres differs according to the scope (local, regional, national, or international) and to the substance. There is a curve between the disturbance of the homeostatic system and the disability scale. A problem of lead is presented as such a case. Adapatation, the ability to harmonize the environment and mankind, and the ability to adjust the relationship to the neighboring society are discussed. The automatic development of modern science and technology beyond these abilities is considered.

49253 **APTIC NO. 71343**

Tanaka, M. and E. Momo

EFFECTS OF AIR POLLUTION ON RESPIRATORY SYSTEM IN OTAKE, KURE AND FUKUYAMA CITIES IN 1973 (PART I). *(Otake, Kure oyobi Fukuyama ni okeru taikosen no kokyuki ni oyobosu eikyo, showa 48-nendo). Text in Japanese. Hiroshima Igaku (J. Hiroshima Med. Assoc.), 28(2):156-164, Feb. 1975. 5 refs.*

A survey of the effects of air pollution on the respiratory system was carried out on randomly selected women older than 40 from both polluted and non- or slightly polluted areas of three cities, Otake, Kure and Fukuyama. Surveyed were basal metabolic rate, lung function, blood pressure, urinalysis, chest roentgenography, and a medical interview on subjective symptoms of eyes, nose, and pharynx. Morbidity was high for dyspnea and rhinitis in winter. In general, for many symptoms the morbidities were lower than those measured in 1972, especially in air polluted areas, showing no tendency to suggest the effects of air pollution. However, there were many areas in which the inhabitants showed abnormal lung function, and complained of subjective symptoms of eyes, nose, and pharynx. The survey in 1973 showed a relatively improved health situation with reference to the respiratory system as compared to those in 1972; however, the state of subjective symptoms was not as satisfactory.

49254 **APTIC NO. 71344**

Tanaka, M. and E. Momo

RESULTS OF AN EPIDEMIOLOGICAL SURVEY OF CHILDREN WITH BRONCHIAL ASTHMA IN KURE, OTAKE, AND FUKUYUMA CITIES (PART II). *(Kure, Otake oyobi Fukuyama shi ni okeru kikanshizensoku-ji no ekigakuteki chosa seiseki). Text in Japanese. Hiroshima Igaku (J. Hiroshima Med. Assoc.), 28(2):165-171, 1975. 2 refs.*

An epidemiological survey was done on children from primary and middle schools in three cities, Kure, Otake, and Fukuyama, investigating the morbidity of bronchial asthma. The patients were screened in three stages, the numbers of each screening being 1056, 153, and 47, respectively. There were some schools in which children showed a significantly high morbidity of bronchial asthma in Kure and Otake Cities, suggesting the relationship to air pollution. Children in middle schools in Fukuyama City also showed a relatively high morbidity of bronchial asthma.

49255 **APTIC NO. 71484**

Ueda, K.

STUDIES AND COUNTERMEASURES FOR DISEASES DUE TO ENVIRONMENTAL POLLUTION. *(Kogaibyo no kenkyu to taisaku). Text in Japanese. Karada no Kagaku (Pop. Med.), no. 61:67-73, Jan. 1975.*

Recent cases of health disturbances of epidemiological proportions are to environmental pollution caused by an error of industry or administration are described. Health disturbance symptoms due to air pollutants such as sulfur oxides, nitrogen oxides, carbon monoxide, photochemical smog, lead, fluorides, cadmium, vanadium, benzopyrene, asbestos, and other carcinogenic substances were described. Countermeasures such as the establishment of environmental standards for each pollutant and total air quality are described. Regulation of sulfur oxides has good prospects, but that of nitrogen oxides has many problems. Evaluation of the analytical value of a pollutant must be considered in relation to other values of materials. The new law which necessitates the evaluation of any new substance to be introduced in commerce will greatly contribute to environmental health.

49256 **APTIC NO. 71329**

Wada, O.

APPROACH TO ENVIRONMENTAL HEALTH. *(Kankyo hoken eno appuroochi). Text in Japanese. Ao to Midori (Blue Green), 4(1):48-54, Dec. 1974/Jan. 1975.*

The toxicological and ecological approaches to environmental health are reviewed. Topics discussed include prevention of health impairment due to symptoms not yet recognized as being caused by air pollution; the necessity of distinguishing between air pollution-related diseases and health problems with different etiologies; and the recommendation to perform and epidemiological survey of health impairment due to air pollution.

49257 **APTIC NO. 71328**

Yoshida, K.

AIR POLLUTION AND ENVIRONMENTAL HEALTH. *(Taikiosen to kankyo hoken). Text in Japanese. Ao to Midori (Blue Green), 41(1):44-47, Dec. 1974/Jan. 1975.*

Environmentally-related health problems such as Minamata disease, itai-itai disease, and obstructive lung diseases such as asthma prevailing widely in Japan are discussed. The relationship between such health disorders and pollution, especially air pollution, is difficult to confirm. The role of epidemiology in finding such a relationship is discussed with reference to Yokkaichi and the development of a legal compensation system. Although the problem of sulfur dioxide is being resolved, problems of pollution due to nitrogen oxides and photochemical oxidants still must be studied. Initial prevention of environmental pollution is the object of environmental health and sanitation.

1974

49258 **APTIC NO. 70512**

asmadshijewa, K. and K. Dawidkowa

IOCHEMICAL AND MORPHOLOGICAL CHANGES IN ALINO MICE WHICH WERE TREATED WITH ARSENIC TRIOXIDE. *(iochemische und morphologische Veraenderungen an Aibinomaeusen, die mit Arsentrioxid behandelt wurden). Text in German. Z. Ges. Hyg. Ihre Grenzgebiete (erlin), 20(9):586-588, 1974. 16 refs.*

The carcinogenic and gonadotropic effect of arsenic trioxide, the arsenic compound found most frequently in atmospheric air, was determined with 40 mice hybrids divided into five groups. Arsenic trioxide was applied subcutaneously in quantitites of 0.22 micrograms/kg to group 1, 2.2 micrograms/kg to group 2, 1200 micrograms/kg to group 3, and 2400 micrograms/kg to group 4. Group 5 was used as a control group. The effect of the pollutant was checked 24 hr after application by determining the DNA and RNA in liver and testes by the method of Zanew and Markow, the soluble protein in liver homogenates by the method of Lauri, and the DNAase-activity in the lysogenic fractions of the liver by the method of Diske-urtou. The results show that arsenic trioxide reduces the nucleic acid content in the liver and the testes. The quantity of the measured DNA depended on the amount of As2O3 which had been applied. Arsenic trioxide also exerted an influence on all other examined biochemical and morphological parameters.

49259 **APTIC NO. 70469**

Crews, W. Brian and Michael Truffer

A PRELIMINARY MODEL OF THE HUMAN ASSIMILATION OF LEAD AEROSOLS FROM GASOLINE COMBUSTION. *Preprint, California Univ., Davis, Dept. of Mechanical Engineering and Dept. of Zoology, 11p., 1974 (?). 25 refs.*

The potential human health hazard of lead anti-knock additives in gasoline was evaluated using simulation techniques. Two simulation models were developed. The first consists of a very simple solution to the mass continuity equation. Given inert, rather long residence time aerosols over large homogenous area sources, the equation can be reduced on a one-dimensional box model: the average monthly atmospheric lead concentration equals (the discontinuous average monthly source function of lead times the length of a side of the control volume over the urban area) divided by the average monthly resultant wind velocity times the average monthly inversion base height. The simple model was compared to actual lead measurements for San Diego and Los Angeles. The results showed the California limit of 1.5 micrograms/cu m for a 30-day average may be violated in the winter even with all low-lead gasoline. A preliminary human lead assimilation model was also studied using gasoline consumption and food as inputs of lead exposure. When the model was compared to dose-response data from laboratory and field studies, it appeared to reflect the kinetics of lead in the human body. Coupling of worst case inputs with the model showed body burdens would be slightly elevated, but the combustion of leaded gasolines may not pose a significant public health hazard in the future. Reasons for caution in evaluating the results of this preliminary work are discussed. The results indicate the California limit of 1.5 micrograms/cu m for a 30-day average may be slightly conservative, while a 10 micrograms/cu m limit as has been proposed may be inadequate to protect public health.

49260 **APTIC NO. 71479**

Ebert, Johannes and Herbert Jungmann

RAPID AND SENSITIVE DETERMINATION OF LEAD IN URINE BY FLAMELESS ATOMIC ABSORPTION SPECTROMETRY. *(Schnelle und empfindliche Bestimmung von Blei in Urin mittels flammenloser Atomabsorptionsspektrometrie). Text in German. Fresenius Z. Anal. Chem., 272(4):287-288, 1974.*

The applied lead determination methods for urine or blood with the aid of flameless atomic absorption spectrometry are satisfactory only with regard to blood analyses. For urine the detection limit is 50 micrograms Pb/l. A marked increase of the lead signal without separating or concentrating operation can be achieved by addition of ethylenediaminetetraacetic acid or DCyTE. Aliquot amounts of a urine sample (with a lead content of 50 micrograms Pb/l urine produces signals higher by up to a factor of 18 with increasing EDTA concentrations. For this, EDTA containing samples were dried in a graphite tube at 100 C, ashed at 330 C, and atomized at 1100 C. Detailed instructions of the new method are given.

49261 **APTIC NO. 70402**

Finklea, John F., Carl M. Shy, John B. Moran, William C. Nelson, Ralph I. Larsen, and Gerald G. Akland

THE ROLE OF ENVIRONMENTAL HEALTH ASSSESSMENT IN THE CONTROL OF AIR POLLUTION. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., Office of Research and Development, 94p., Aug. 27, 1974. 244 refs.*

The relationship between environmental health and the control of air pollution is discussed. The Clean Air Act, as amended in 1971, provides for the establishment and attainment of health related ambient air quality standards for ubiquitous air pollutants arising from multiple sources: particulate matter, sulfur oxides, nitrogen dioxide, carbon monoxides, hydrocarbons, and photochemical oxidants. The Act specifically requires that primary air quality standards be set to fully protect public health and that the standards contain an adequate margin of safety. The health assessments required to evaluate air quality standards and to support decisions on the control of mobile and stationary source emissions are complex. There are large differences between upper and lower boundary estimates of a threshold for adverse health effects, and there may be conflicting effects. Oxidation catalysts on motor vehicles reduce carbon monoxide, phenols, aldehydes, and polynuclear aromatics, but increase sulfates and sulfuric acid emissions.

49262 **APTIC NO. 70956**

Fujishiro, Z.

THE EFFECTS OF AIR POLLUTION ON THE UPPER AIRWAY. *(Taiki osen no jokido ni oyobosu eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):312, Nov. 1974.*

The findings of examination of nasal cavity and laryngopharynx of 177 children in a primary school where severe respiratory damage was reported on June 28, 1970 in a zone including Kisarazu City, Chiba Prefecture are described. The topical findings were conspicuous redness on the mucosa of the posterior wall of the middle larynx, large amounts of liquids in the nasal cavity of those who showed redness in the nasal mucosa, and a small number of cases with redness in the pharynx with swelling. In those who had asthmatic histories, these findings were most conspicuous. Statistically, the percentage of schoolchildren who showed acute symptoms was 40 in primary school, and 25 in middle school, and 82% complaining of pain in the chest and severe cough. On the day in question, the concentration of sulfur oxide was 0.07-0.11 ppm with floating dust 0.81 mg/cu m and 4.5 m/sec southwest wind. The cause was attributed to photochemical smog mainly consisting of sulfuric acid mist.

49263 **APTIC NO. 68942**

Gordon, T. and D. Pistorius

LUNG FUNCTION ANALYSES IN ANIMALS DURING INHALATION OF ZINC OXIDE DUST. *(Tierexperimentelle Lungenfunktionsanalysen waehrend Inhalation von Zinkoxidstaub). Text in German. Zentralbl. akteriol. Hyg. Infektionskr. Abt. Orig. A. 227(1-4):116-120. 1974. 3 refs.*

Female Wistar rats grouped according to weight were exposed to 15 mg zinc oxide/cu m air. A first group was exposed 1 hr. a second group 4 hr and a third group 8 hr per day to ZnO for 14, 28, 56 or 84 days. The lung functions of each animal were measured 24 hr after termination of the dust exposure in a plethysmograph. Inhalation volume, frequency, and inhalation time quotient of all animals were within the physiological range throughout the entire exposure time and did not deviate from the control group. The conductance, however, displayed a decreasing tendency during the entire exposure time and was particularly pronounced 4 wk after ZnO exposure. Since the decrease occurred in all animals irrespective of the length of daily exposure, the effect seems to be due to the concentration of 15 mg/cu m rather than to total quantity of dust inhaled.

49264 **APTIC NO. 71169**

Green, A. E. S. and T. Mo

ULTRAVIOLET, OZONE AND SKIN CANCER. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 313-335, Dec. 11-12, 1974. 29 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The relationship between anthropogenic releases of chlorofluoromethanes and skin cancer caused by increased ultraviolet radiation is discussed. These compounds are inert chemically and have long atmospheric lifetimes (exceeding 10 yr) which are controlled by diffusion into the stratosphere where the solar ultraviolet light can photodissociate the compounds and release chlorine atoms. The present usage levels of chlorofluoromethanes can lead to ozone destruction rates exceeding natural sinks of O3 by 1985 and 1990. If O3 depletions occur, enhanced ultraviolet radiation will reach the ground and cause corresponding increments in skin cancer incidence. It is not unreasonable to use a nominal amplification of 2 to translate O3 depletions to increments in skin cancer incidences. An epidemiological index for skin cancer incidence was determined based upon analytical form for the latitudinal dependence of annual ultraviolet erythema dose. Allowances are made for variation in cloud cover, cloud and smog thickness, ground albedo, and ground elevation. (Author abstract modified)

49265 **APTIC NO. 70957**

Hanioka, N., Y. Yamada, T. Eguchi, K. Nagayama, K. Shirakami, J. Ueda, H. Maruya, and Y. Morita

RESULT OF HEALTH EXAMINATION OF SCHOOLCHILDREN: PART 4. COMPARISON OF MORBIDITY OF ASTHMA AND THE RESULT OF CHEST ROENTGENOGRAPHY. *(Kurashiki-shi gakudo no kenko chosa, dai 4ho: Mizushima, Ukan gakudo no zensoku yusho-ritsu to X-sen kenshin kekka). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):311, Nov. 1974.*

In the present survey, schoolchildren having chronic bronchitic symptoms, those having stridor, and those having a bronchial asthmatic history with claims were chosen as the object of secondary examination. The percentage of those who had secondary examination was 8.9 in Mizushima district and 4.2 in a control (unpolluted) district. The percentage of those who had tertiary examination was 3.6 in Mizushima district and 1.1 in the control district. This finding and the fact that the morbidity of bronchial asthma was 2.2% in Mizushima district are especially noteworthy. Furthermore, the chest roentgenographic findings in Mizushima district were very abnormal compared to those in the control district. The yearly value of sulfur dioxide in air in Mizushima district were 0.045-0.029 ppm in 1970, 0.041-0.029 ppm in 1974, and 0.042-0.028 ppm in 1972.

49266 **APTIC NO. 70949**

Hayashi, K, and R. Yoshida

EXPERIMENTAL STUDIES ON THE EFFECTS OF AIR POLLUTION ON THE ONSET OF BRONCHIAL ASTHMA, PART I. *(Taiki osen no kikanshi zensoku hassho ni oyobosu eikyo ni kansuru jikkenteki kenkyu (dai ippo)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):328, Nov. 1974.*

In order to elucidate the effect of air pollution on the onset of bronchial asthma, the change of histamine-like material and mast cells in the lungs of sensitized female guinea pigs of the Hartley strain was examined following inhalation of 2% egg white, 3 hr/day, once per three days, three times. The distribution of mast cells did not show any change after inhalation of nitrogen dioxide or ozone in normal guinea pigs. The amount of lung histamine-like substance in the sensitized guinea pigs was significantly higher than that of normal animals, and the amount in the sensitized animals decreased significantly after inhalation of NO2 or O3. The change of mast cells was not significant. After exposure to NO2 or O3 or after sensitization, the animals were exposed to histamine inhalation. The result showed that the sensitivity seemed to be raised by NO2-exposure and by sensitization but it seemed not to be raised by O3-exposure.

49267 **APTIC NO. 71337**

Higashida, T.

MOTORIZATION AND CITY LIFE: SURVEY ON THE MOTOR TRAFFIC AND LIVING ENVIRONMENT, PART II. *(Motorizeshion to toshi seikatsu - jidosha kotsu to ju kankyu ni kansuru chosa (dai 2ho)-). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health, Annual Meeting, 33rd, Fukushima, Japan, Oct. 16-18, 1974.)*

The results of a 1973 survey of the awareness of residents of Osaka of the damage, anxiety, and aggravation of environmental conditions caused by traffic are presented. Among the subjective symptoms of health impairment reported, cough, sputum, and throat pain were predominant.

49268 **APTIC NO. 70948**

Ishinishi, Shin and Hasushi Kodama

STUDIES ON GROUP EXAMINATION METHODS FOR ARSENIC POISONING. *(Hiso chudoku no shudan kenshin hoho ni kansuru kenkyu). Text in Japanese. In: Survey and Research Report on Medical Examination Methods for Pollution-Caused Ill Health. 28p., March 1973.*

Examination of arsenic poisoning must include the following: blood test for red blood cell number, hemoglobin, hematocrit and white blood cell number; biochemical tests of serum for glutanic oxaloacetic transaminase, glutamic pyruvic transaminase, icterus index, and lactate dehydrogenase levels; urine test for protein and sugar; chest X-ray; and respiratory function tests. The acute and subacute symptoms for air pollution arsenic poisoning include skin disease, conjunctivitis, bronchitis, liver function retardation, and neuritis. Chronic symptoms include skin cancer, respiratory diseases, lung cancer, and abnormalities of the peripheral nervous system. Arsenic contents in urine, hair, and nails are used as objective measurements for continuous exposure to arsenic chemicals. A value of 0.17 mg/l of As in urine is considered to be a normal level.

49269 **APTIC NO. 71336**

Ito, K.

CLINIC ON COUGH AND SPUTUM: AIR POLLUTION AND COUGH-SPUTUM. *(Seki to tan no rinsho. Taiki osen to Seki to Tan). Text in Japanese. Shinyaku to Chiryo (New Rem. Ther.), no. 191-:10-13, Oct. 1974.*

Cough and sputum are frequent symptoms of air pollution health impairment and their mechanism of occurrence is described. Both are protective reactions to remove foreigh matter such as dust or noxious gases and immunological protection for the respiratory system. However, more than 5 ml/day of sputum is abnormal, and such cases should be examined for purulence, bacteria, and malignant cells. A correlation between air pollution sulfur dioxide and the symptoms of cough and sputum continuing for more than 3 months is generally recognized. The relation was tabulated in actual cases. The clinical treatments, of severe cough and sputum are described.

49270 **APTIC NO. 71482**

Iwase, S.

CLINICAL FINDINGS ON PHOTOCHEMICAL SMOG INJURY NO. 2. *(Kokagaku smog to sono higai no rinsyo 2). Text in Japanese. Nihon Shonika Gakkai Zasshi (Soc. Paediatr. Jap.), 78(11):830, Nov. 1974. (Presented at the Japan Society of Pediatrics Annual Meeting, 77th, Osaka, Japan, May 1974.)*

Symptomatology of middle schoolchildren during an air pollution episode of photochemical smog in Moriguchi City on Oct. 3, 1972, is described. A few children claimed headache, nausea, dizziness, and numbness in the extremities with a few cases of collapse, after playground exercise. Findings on 43 hospitalized children were: major symptoms disappearing within 4 hr; in 3 cases a slight pulmonary emphysema; respiratory alcarosis; a transient increase of leukocytes, especially the neutrocytes; a conspicuous claim of orthostatic dysfunction; and the characteristically large ratio of neutrocyte to lymphocyte. After 1 year no abnormality was noticed, except for a small number of cases of abnormal electroencephalograms. The concentration of oxidants on that day was 0.09 ppm.

49271 **APTIC NO. 71500**

Jones, J. S. P.

PATHOLOGICAL AND ENVIRONMENTAL ASPECTS OF ASBESTOS-ASSOCIATED DISEASES. *Med. Sci. Law (London), 14(3):152-158, July 1974. 39 refs.*

The pathological and environmental aspects of asbestos-associated diseases are reviewed. Diseases associated with inhalation of asbestos dust include: asbestosis, bronchial carcinoma, mesothelioma of the pleura or peritoneum, and pleural plaques. The percentage of autopsies in which asbestos was detected in post-mortem lung tissue is tabulated for geographical areas ranging from unpolluted rural districts to Finnish areas where the prevalence of asbestos is known to be high. The percentage in Finland is 39%. Two London centers, Belfast, Glasgow, Liverpool, and Dresden form a group of industrial centers in which asbestos is widely used, and have an average rate of about 20% positivity. Dorchester (8%) is a small, unpolluted country town, and Nottingham (7%), although an industrial city is mainly free from industries in which asbestos is widely used. Galway (1%) in the non-industrial west of Ireland has minimal asbestos pollution.

49272 **APTIC NO. 71182**

Jonsson, Erland

ANNOYANCE REACTIONS TO ENVIRONMENTAL ODORS. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moul-*

ton (eds.) New York, Academic Press, 1974, p. 329-333. 8 refs.

Various surveys of public annoyance reactions to industrial odors are reviewed. Differences in annoyance reactions observed between different categories of interviewees separated by various demographic variables makes it difficult to establish objective data about the reactions. Odors from pulp mills, oil refineries, and sulfate cellulose factories, however, appear to be particularly objectionable. Although about the same annoyance frequencies are found for similarly designed studies, differences are observed concerning the relationship between annoyance reactions and frequency of reported symptoms. Percentages of annoyed respondents reporting symptoms caused by odor exposure range from almost 0 to about 25% for different studies.

49273 **APTIC NO. 71027**

Kamiyama, S.

ON THE RELATIONSHIP BETWEEN RESPIRATORY DISEASE STATES OF CHILDREN AND THEIR LUNG FUNCTION. *(Jido no kokyuki shojo to hai kino tono kanren ni tsuite). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health), 21(10)Suppl. :425, Oct. 1974. (Presented at the Japanese Society of Public Health, 33rd Annual Meeting, Fukushima, Japan, Oct. 16-18, 1974.)*

Constitution and lung function were determined on 89 fifth grade children from a primary school situated in the most severely air polluted area of Akita and compared to that of 220 children from the primary school in the center of the city. The results were compared to the answers of questionnaires on respiratory symptoms. Complaints such as frequent morbidity of bronchitis, long period of treatment, and cough with sputum were more numerous in the children of the air polluted area; however, there was no marked difference in the results of examination of lung functions such as vital capacity, 1-second volume, peak flow value, respiratory flow volume, and their ratios. The only significant difference was the decrease of the end part of the flow-volume curve (V10/V5).

49274 **APTIC NO. 71476**

Kanegami, H.

QUESTIONS AND ANSWERS CONCERNING THE TRUE STATE OF PHOTOCHEMICAL SMOG. *(Kokagaku smog no hontai to chiryoho). Text in Japanese. Meijikaru Nyusu (Med. News), no. 146:20-21, July 1974.*

Hydrocarbons and nitrogen oxides in air react with sunshine to form new compounds of which oxidizing substances such as ozone and peroxyacetyl nitrate are collectively called oxidants. Oxidants formed under special weather conditions are called photochemical smog and consist mainly of ozone with a small amount of nitrogen dioxide. The biological effects of photochemical smog are an abnormal odor at 0.02 - 0.05 ppm; drying of the nose, airway, and mucous membranes at 0.05 - 0.02 ppm; and irritation of the mucous membrane causing symptoms such as cough, sputum, sore throat, and conjunctivitis. At higher concentrations it causes a decrease of pulmonary diffusive ability with exposures of 0.6 - 0.8 ppm for 2 hr. Data on accidental inhalation of ozone shows the occurrence of emphysema at 0.8 - 1.7 ppm for 2 hr and the dryness and irritation of mucosa, nervous disabilities, headache, numbness in extremities, and loss of appetite at 0.5 ppm for 3 min. The symptoms increase at the same concentrations during exercise.

49275 **APTIC NO. 71046**

Kawai, K.

EXAMINATION OF THE RELATIONSHIP BETWEEN AIR POLLUTANTS AND THEIR CARCINOGENICITY BY INHALATION EXPERIMENTS. *(Taiki osen to hatsugansei: Kyunyu jikken ni yoru kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):138-139, Nov. 1974.*

Rats were raised in an artificially polluted environment consisting of an inhalation box containing the products of burning heavy oils such as 6.3 mg/cu m of dust particles, 18.08 ppm of sulfur dioxide, 35.45 ppm of carbon monoxide and 3.85 ppm of nitrogen oxides (NO2/NO 1/10). The pathological findings on the rats so far obtained include acute to chronic respiratory disturbances such as laryngitis, bronchitis, generalized bronchiolitis, anthracosis, lymphoanthracosis, inflammation of alveolar septum, diffused pulmonary fibrosis and initial signs of pulmonary emphysema, all of which resembled those of humans. No cases were found of onset of pulmonary cancer; however, there were several interesting findings of development of airway inflammation from the viewpoint of carcinogenesis such as electro microscopically found slight proliferation of the deep part of the mucosal epithelium of bronchioles, horizontal heterotropic proliferation of bronchiolar epithelium accompanying generalized bronchiolitis, and peripheral squamous epithelial metaplasia.

49276 **APTIC NO. 70810**

Kay, Allen I.

EFFECTS OF IRRADIATED AND NON-IRRADIATED AIR POLLUTANTS ON LIPID MONOMOLECULAR FILMS. *Rutgers Univ., New Brunswick, N. J., Dept. of Pharmaceutical Sciences, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1974. 95p. 111 refs.*

Monomolecular films of the lipid compounds dipalmitoyl lecithin, egg lecithin, phosphatidyl ethanolamine, and cholesterol were employed as in vitro cell membrane models and exposed to air, ozone, and irradiated and non-irradiated nitrogen dioxide to study the reactions between lipids and pollutants known to cause pulmonary edema. Surface pressure-surface area curves were constructed with the Wilhelmy plate method, and pollutant-film interactions were measured by changes in the curves. The curves of dipalmitoyl lecithin monolayers exposed to air and ozone for 1 hr were identical, indicating the ozone did not react with the saturated lipid, whereas changes were observed for the curves of egg lecithin and phosphatidyl ethanolamine following ozone exposure, indicating the addition of ozone to the double bonds of these unsaturated phospholipids to form ozonides which subsequently hydrolyzed to yield aldehydic lecithins. Ozone did not react with cholesterol films. Exposure of dipalmitoyl lecithin to 470 ppm NO2 or irradiated NO2 for 1 hr did not result in any change in the monolayers, whereas egg lecithin and phosphatidyl ethanolamine films exposed to the same concentration of NO2 were considerably expanded. Exposure to irradiated NO2 resulted in an even greater expansion. Cholesterol films were significantly condensed following exposure to 175 ppm NO2, though they were unaffected by exposure to irradiated NO2. The ultraviolet radiation appeared to convert the NO2 to nitric acid which was capable of addition to the unsaturated phospholipids. Antioxidants dissolved in the subphase or incorporated into the lipid films offered no protection against film attack by ozone, NO2, or irradiated NO2. Thus, pollutants known to produce edema (ozone, NO2, nitric acid vapor) exerted a marked effect on unsaturated phospholipids and cholesterol films but not on saturated phospholipid films.

49277 **APTIC NO. 70341**

Kimura, K.

AUTOMATIC ANALYSIS OF FLOW-VOLUME CURVE Y MINICOMPUTER. *(Konpyuta ni yoru jidokaiseki). Text in Japanese. Nippon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis.), 12(10):572, Oct. 1974.*

The problem of increasing respiratory diseases due to air pollution has intensified the requirements for respiratory function examinations. For resolving one of the requirements, the merits of introducing a computerized system on analysis of flow-volume curves were examined. The merits found were: a check of efforted expiration could be done objectively resulting in suppressing the fluctuation due to insufficient cooperation of the objects; there was no load on the examiner due to the calculation of data; the method was time-saving; and it was a sub-system which could be combined into a larger examination of respiratory function.

49278 **APTIC NO. 70377**

Kodama, Y., K. Nobutani, Y. Fukushima, M. Iwasa, N. Ishinishi, and E. Kunitake

EPIDEMIOLOGICAL STUDIES ON THE ADJUSTED DEATH RATE OF LUNG CANCER AMONG RESIDENTS IN INDUSTRIAL AND COMMERCIAL CITIES. *(Kitakyushu- shi, Yahata-ku, oyobi Fukuoka-shi jumin no haigan shiboritsu ni kansuru ekigakuteki kenkyu (showa 39 - 44 nen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):596, Nov. 1974.*

ased on the death notices in the Yawata Ward of Kitakyushu City and Fukuoka City, the sex, the age, smoking history, occupational history, and residence history of each death were investigated concerning the new international classification No. 162. On the other hand, the same investigation was carried out on the extracted samples of both cities population. Thus, the causes of death by lung cancer of the two cities were compared. In Yawata Ward, the death rate by lung cancer was greater in those having a history of air pollution exposure, and in males the mortality by lung cancer was significantly higher in those having a smoking history and a harmful occupational history. The epidemiological causes of lung cancer are smoking, harmful occupational history, and air pollution, in the above order.

49279 **APTIC NO. 70373**

Lewis, Trent R., William J. Moorman, You-yen Yang, and Jerry F. Stara

LONG-TERM EXPOSURE TO AUTO EXHAUST AND OTHER POLLUTANT MIXTURES. *Arch. Environ. Health, 29(2):102-106, Aug. 1974. 16 refs.*

eagles were exposed 16 hr daily for 61 months to raw and photochemically reacted auto exhaust, nitrogen oxides, and sulfur oxides, alone and in combination. Exposure to NOx reduced diffusion capacity and peak expiratory flow, while raw exhaust and raw exhaust combined with SOx produced pulmonary hyperinflation. Irradiated auto exhaust, along and in combination with SOx, produced increased expiratory resistance. Irradiated auto exhaust also impaired ventilatory distribution. Lung volumes, compliances, and maximum breathing capacity were not impaired by the experimental atmospheres. The results indicated that long-term, low-level exposure to ubiquitous urban air pollutants poses potential serious health hazards. (Author abstract modified)

49280 **APTIC NO. 70951**

Mizoguchi, I., S. Osawa, M. Fukuda, Y. Sato, K. Makino, and H. Yagyu

STUDIES ON PHOTOCHEMICAL SMOG AND ERYTHROCYTES: PART II, EFFECT OF AIR POLLUTANTS ON THE RESISTANCE OF ERYTHROCYTE TO OSOMOTIC PRESSURE. *(Kokagaku sumoggu to sekkekkyu ni kansuru kenkyu -dai 2ho- sekkekkyu teiko ni oyobosu osen busshitsu no eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):334, Nov. 1974.*

Blood of male rabbits, exposed respectively to ozone at 2, 1 and 0.5 ppm and to toluene at 900 ppm, for 3 hr/day, was taken just after, four, and 24 hr after the end of exposure, and the erythrocyte s resistance to osmotic pressure was determined by cyclic path centrifuge method. Although it is reported that the erythrocyte resistance to osmotic pressure increased after exposing rabbits for 30 min at 1 ppm of ozone when determined by Ribiere s method, the exposure for 3 hr at 1 ppm did not cause an increase of erythrocyte resistance when determined by cyclic path centrifuge method. However, after 3 hr exposure at 2 ppm of ozone the erythrocyte resistance decreased.

49281 **APTIC NO. 71141**

Mustafa, Mohammad G.

AUGMENTATION OF MITOCHONDRIAL OXIDATIVE METABOLISM IN LUNG TISSUE DURING RECOVERY OF ANIMALS FROM ACUTE OZONE EXPOSURE. *Arch. Biochem. Biophys., 165(2):531-538, 1974. 33 refs.*

Recovery in terms of alteration in lung mitochondrial oxidative metabolism was studied in male Sprague-Dawley rats following exposure to concentrations of ozone (3 ppm for 4 hr) sufficient to produce lung injury. Succinate oxidation in lung homogenate (oxygen consumption observations) exhibited a 20% decrease immediately following exposure but attained a control rate (0.6 micromole O2/min/lung) within 12 hr and a peak rate (55% over control) within 48 hr of recovery. Thereafter, the rate plateaued and began to decline at about the fifth day, exhibiting only a 15% increase over the control value after 21 days. The half-life for duration of this augmentation was 10 days. The yield of isolated mitochondria (mitochondrial packed volume and protein content) during recovery was increasingly greater for exposed lungs relative to controls (25-30% increase after 96 hr). Mitochondria from exposed lungs exhibited a 17-24% increase in activity (per mg protein) for oxidation of the substrates 2-oxoglutarate, succinate, glycerol-1-phosphate, and ascorbate- Wurster s blue. The overall augmentation of O2 consumption in exposed rat lungs was thus attributed primarily to an increase in mitochondrial population. Enhanced mitochondrial metabolism might possibly serve as an index for assessing the repair process of injured lung. (Author abstract modified)

49282 **APTIC NO. 71334**

Nagaoka, S.

HEALTH DISTURBANCE DUE TO PHOTOCHEMICAL SMOG. *(Kokagaku-smog ni yoru shogai). Text in Japanese. Med. Corner (Japan), no. 30:71-77, Sept. 1974.*

An outline of the problem at photochemical smog over the last 5 years in Japan is given. The formation of aerosols is also due to photochemical reactions with chemicals other than ozone and that the accurate components of photochemical smog have not been fully elucidated. Human health effects of photochemical smog have not been completely recognized; eye irritation, throat pain, constriction of bronchus, irritation of bronchioles by secondary pollutants, possible decrease of resistance to infection, and motor disturbances were seen in laboratory animals. The major cause of photochemical smog is attributed to automobile exhaust.

49283 **APTIC NO. 71323**

Nakagawa, T. and A. Miyamoto

MECHANISM OF ASTHMATIC PAROXYSM: ASTHMA SEEN FROM PATHOLOGIC PHYSIOLOGY. *(Zensoku-hossa no mekanizumu; Byota-seiri kara mita zensoku). Text in Japanese. Medicina (Medecine (Japan)), 11(12): 1528-1531, Dec. 1974. 26 refs.*

In general, a specific allergen or non-specific stimulation by air pollutants such as dust, sulfur dioxide, and nitrogen dioxide attack the hypersensitive bronchi causing contractions of the unstriated muscles and mucosal edema of the airway and excessive secretion of airway mucus. These alterations cause in change in obstructive abilities of the airway to cause asthmatic paroxysms. The mechanism of allergic reactions is explained, with emphasis on air pollutants such as house dust, formalin, and cement dust. The non-specific mechanism other than allergic reactions was based on airway stenosis which was stimulated by sulfur dioxide, nitrogen dioxide, coal dust, and cold temperatures.

49284 **APTIC NO. 71330**

Nakamura, R.

ON THE EFFECTS OF AIR POLLUTION ON THE FETUS AND PLACENTA. *(Taikiosen ga taiji ni* *oyobosu eikyo ni tsuite). Text in Japanese. Bosei Eisei (Jap. J. Matern. Health), 14(3/4): 40, March 1974.*

The weight-ratio of placenta to fetus (P/F), the water content of the placenta, and histological changes of the placenta were compared among 49 cases in an air polluted area and 58 cases in a non-air polluted area in Yokkaichi City from Sept. - Oct. 1972. The average values of P/F were 0.165 in the air polluted area and 0.158 in the non-air polluted area, and the average water content of placenta in the polluted area was significantly larger (84.69%) than that of the non-polluted area (84.08%). Histologically, atrophy and fibrosis were significantly frequently seen in the placenta in the air polluted area and a tendency of calciocosis was also found; however, significant denaturation of the fibrinoids and thickening of vessels was not seen. The concentration of sulfur oxides in both areas was, respectively, 0.0319 and 0.0189 ppm.

49285 **APTIC NO. 71474**

Nakano, Michio

ON THE PROBLEM OF PHOTOCHEMICAL AIR POLLUTION IN OSAKA. *(Osaka ni okeru kokagaku taiki osen mondai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 10(10):23-36, Oct., 1974.*

Photochemical smogs in Osaka Prefecture injured more than 1600 persons each year in 1971 and 1972, and more than 3000 persons in 1973. On August 27, 1971, photochemical smog occurred in the Osaka Prefectural University area where the oxidants concentration reached 0.24 ppm at 2-2:30 pm. Students of a nearby junior high school and workers at an electric company were injured while playing a softball game. The major symptoms were irritation of the eyes and respiratory system. Seven students were injured and hospitalized while practicing baseball. On September 2 of the same year, photochemical smog occurred in the same area and two junior high school students were hospitalized for serious eye irritation, headache, throat pain, chest pain, and dizziness. Air pollution prevention laws state that forecast, warning, and alert of photochemical smog must be issued when the oxidant concentration exceeds 0.10 ppm, 0.15 ppm, and 0.30 ppm, respectively. Exhaust reduction must be requested from factories and traffic control must be conducted during alerts.

49286 **APTIC NO. 71324**

Nakaya, S., S. Sakurai, Y. Suzuki, K. Itai, and F. Tsunoda

ON THE QUANTITATIVE DETERMINATION OF FLUORINE IN URINE BY ION ELECTRODE. *(Ion denkyoku ni yoru nyochu fusso teiryoho ni tsuite). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 16(4):498, Sept. 1974. (Presented at the Tohoku Lecture Meeting, 32nd, Yamagata, Japan, July 20, 1974.)*

The fluorine content of urine collected over a 24-hour period can be used as a biological indicator of exposure to fluorine compounds in the air. Several conditions of pre-treatment and preservation of the urine specimen were examined. The stability of 10 ml aliquots kept in closely stoppered vials was better than the 2000 ml sample kept in a stoppered bottle, considering time and temperature. One hundred percent fluorine was shown after 3 weeks. The standard deviation after keeping for 3 weeks at 0 C and 24 C was very small compared to 40 C. Fluorine contents were quantified by the ion-electrode method.

49287 **APTIC NO. 70955**

Nakayama, N., M. Ueda, and Y. Tsunetoshi

SURVEY OF SCHOOLCHILDREN S BRONCHIAL ASTHMA AND AIR POLLUTION. *(Gakudo no kikanshi zensoku chosa to taiki osen). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):313, Nov. 1974.*

A survey of childrens bronchial asthma was carried out by extracting those having asthma and asthmatic bronchitis at first by inquiry, then by physical examination, intracutaneous reaction, blood examination, chest roentgenograph and medical history. To the children diagnosed as asthmatic and asthmatic bronchitic by the above examinations special diaries were given and the state of school absence was investigated to determine the acute effect of air pollution. Also, follow-ups were carried out on the same children to determine the relationship between prognosis and air pollution. The result of such a survey on 39,000 schoolchildren in four districts of Osaka Prefecture showed that the morbidity of asthmatic bronchitis was higher in polluted districts; there was no difference of the morbidity of asthma itself between districts; and the rate of positive intracutaneous reaction was lower in polluted districts even with the same symptoms. According to the follow-up survey, the percentage of healing of asthma and asthmatic bronchitis decreased as the pollution increased, and aggravation and recurrence of the disease were more frequent in polluted districts.

49288 **APTIC NO. 71025**

Nakayama, N., M. Ueda, T. Shimizu, and Y. Tsunetoshi

EFFECTS OF AIR POLLUTION ON THE HEALTH STATE OF SCHOOLCHILDREN PART II. *(Taiki osen ga gakudo no kenko ni oyobosu eikyo (2)). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health), 21(10)Suppl.:426, Oct. 1974. (Presented at the Japanese Society of Public Health, Annual Meeting, 33rd, Fukushima, Japan, Oct. 16-18, 1974.)*

Examinations were carried out on children living in four districts of Osaka Prefecture who were patients of asthma, asthmatic bronchitis, or those having such a disease history by examination two years earlier. The concentration of SO2 in the four parts was respectively 2.26 (N), 0.52 (H), 10.27 (T) and 0.27 (K) mg/day/100 cu m in 1971. The number of subjects were 117 (N), 107 (H), 84 (T), and 81 (K) for asthma, and 251 (N), 120 (H), 86 (T), and 109 (K) for asthmatic bronchitis. The number of subjects showing positive intracutaneous reaction was lower in the N district, and higher in the H, T and K districts both in asthma and asthmatic bronchitis. The number of subjects complaining of neither asthmatic nor stridor fit since the former examination was smaller in the group who showed positive intracutaneous reaction than in the group who showed negativity, both of which showed asthma and asthmatic bronchitis two years ago. That is, the percentage of healing decreased as the air pollution increased. The percentage of aggravation and the percentage of disease recurrence were highest in the most polluted district, N.

49289 **APTIC NO. 71079**

Nogami, H., H. Oda, S. Kusumoto, E. Yonekawa, Y. Tsubota, and T. Nakajima

EFFECTS OF SUBACUTE EXPOSURE OF NITRIC MONOXIDE ON MOUSE. *(NO akyusei bakuro no mausu ni oyobosu eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):337, Nov. 1974.*

Female mice of JCL-ICR strain were exposed continuously to 10 ppm nitric oxide with 1-1.5 ppm nitrogen dioxide for 2 wk (24 hr/day). When compared to control mice, there is no difference in body weight increase, blood properties (except for a significant increase of leukocyte count), biochemical parameters, the weight ratio of organs to body weight (except for lung, spleen, and kidney). No difference was found in the increase of NO-hemoglobin between the blood of mice exposed 1 hr, 1 wk, and 2 wk. Increase of methemoglobin showed the same trend. The increase of methemoglobin, of the ratio of weights of lung, kidney, and spleen to body weight, and of leukocyte count represents the hazard due to exposure to nitric oxide. Pathohistological findings of several organs were also reported.

49290 **APTIC NO. 70954**

Nose, Y. and K. Nose

THE RELATIONSHIP BETWEEN AIR POLLUTION AND RESPIRATORY DISEASES OF CHILDREN, ESPECIALLY ON THE JUVENESCENCE OF CHILD PATIENT. *(Taiki osen to shoni kokyuki shikkan tono kan-*

ren, tokuni kanji no nenrei zenshin gensho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):314, Nov. 1974.

Epidemiological characteristics of the relationship between air pollution and the childhood respiratory diseases bronchitis, chronic bronchitis, and asthma were investigated in 82,306 children younger than 14 from seven industrial cities in Western Japan. The parameters examined were frequency of onset, sex, age, and locality. The frequency of asthma was higher in the polluted districts and the disease was concentrated in babies and infants.

49291 **APTIC NO. 71026**

Nukada, Y.

RESPIRATORY DISEASES OF CHILDREN DUE TO AIR POLLUTION: AN ANALYSIS OF APPLICATION DOCUMENT OF AUTHORIZING HEALTH DISTURBANCE IN OTA-WARD, TOKYO. *(Taiki osen ni tomonau shoni no kokyuki shikkan ni tsuite - Ota-ku ni okeru kenko shogai nintei shinseisho no bunseki). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health), 21(10)Suppl.: 427, Oct. 1974, (Presented at the Japanese Society of Public Health, 33rd Annual Meeting, Fukushima, Japan, Oct. 16-18, 1974.)*

The items noted by the 858 applicants who presented applications for authorizing health disturbance in Ota-Ward in 1973 were analyzed. The applications were more numerous in the Kojiya and Kamata areas, situated in industrial zones, and less numerous in Yukigaya and Omori, situated in residential zones. The age of onset of bronchial asthma coincided fairly well with the age distribution of patients of asthmatic bronchitis. Sixty percent of patients with onset at younger than 3 yr were diagnosed as asthmatic bronchitis. Seventy percent of patients with onset at older than 3 yr were diagnosed as bronchial asthma. The characteristics of asthma were cough and sputum at night, or night and morning, frequent stridor, and frequent dyspnea during colds. Those of bronchitis were continuous cough and sputum, stridor during colds, and dyspnea during colds with pyrexia. The season of the two diseases was uncertain.

49292 **APTIC NO. 71325**

Ohmori, K., K. Abe, T. Tozawa, K. Nakano, S. Hidaka, and E. Yoneyama

A SURVEY ON THE EFFECTS OF GASES PRODUCED IN SOME RECLAIMED GROUNDS. *(Umetate shobunchi ni okeru hasseigasu no seitai eikyo ni kansuru ichi kosatsu). Text in Japanese. Yokohama Igaku (Yokohama Med. J.), 24(5/6):177-181, 1974. 12 refs.*

A survey of the gases emitted from reclaimed ground containing urban dusts and garbage in Yokohama City was carried out to examine the occupational health of the workers. Gas chromatographic qualitative analysis of the gas showed the existence of nitrogen, hydrogen, methane, carbon monoxide and two unknown gases; the detector tube showed 3 ppm hydrogen sulfide, 0.01% hydrocarbons, and the absence of ammonia and sulfur dioxide. However, at the height of respiration of the workers, and air contained very small amounts of these poisonous gases. Occupational risk is minimal due to diffusion of the gases.

49293 **APTIC NO. 70803**

Omichi, S. and H. Kita

EFFECTS OF AIR POLLUTANTS ON THE MOVEMENT OF CILIA IN AIRWAYS. PART II. *(Kido senmo undo ni oyobosu taiki osen busshitsu no eikyo (II)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):333, Nov. 1974.*

The movement of cilia on ciliated epithelium taken from the trachea of sacrificed guinea pig was observed by oscilloscope with a recorder via phase-contrast microscope under the influence of various concentrations of sulfur dioxide, nitrogen dioxide, nitric oxide, ozone, and formaldehyde, respectively. The movement of cilia (beat/min) observed under ordinary atmosphere was 220 at 8 C, 810 at 39 C and then decreased with thee increase of temperature, stopping at 45 C, and it was reversible in the range from 8 to 35 C. It was 675 + or - 13 just after preparation and 677 + or - 100 after 150 min of preparation of the specimen. The half life of cilial function (time lapsed after which the beat decreased to 50%) at 50 ppm of gases was 4, 5, 10, 14 and 20 min, respectively by SO2, formaldehyde, NO2, NO and ozone.

49294 **APTIC NO. 71332**

Ovcharenko, N. V.

THE LATENCY PERIOD OF PNEUMOCONIOSIS FOLLOWING DETECTION OF THE INITIAL FORM OF LUNG FIBROSIS IN MINERS WITH NASOPHARYNGEAL INFECTIONS. *(O vremeni vozniknoveniya pnevmokonioza posle obnaruzheniya nachal noy formy fibroza legkikh u shakhterov, stradayushchikh nosoglotochnoy infektsiyey). Text in Russian. Gigiena i Sanit., no. 9:109-111, 1974. 2 refs.*

A statistical study on the latency period of pneumoconiosis following detection of the initial form of lung fibrosis in miners with nasopharyngeal infections is presented. Epidemiological surveys conducted revealed that pneumoconiosis is manifested within 3 yr following the detection of initial lung fibrosis under continued exposure to dust. The frequency distribution of the incidence of pneumoconioses with established initial lung fibrosis and nasopharyngeal infection can be described by a gamma-distribution function. Miners presenting initial symptoms of lung fibrosis should be reassigned to jobs involving minimum degree of dust exposure, and be kept under medical supervision to counteract the manifestation of pneumoconiosis.

49295 **APTIC NO. 71431**

Reznik-Schueller, Hildegard and Ulrich Mohr

INVESTIGATIONS ON THE CARCINOGENIC BURDEN BY AIR POLLUTION IN MAN. IX. EARLY PATHOLOGICAL ALTERATIONS OF THE BRONCHIAL EPITHELIUM IN SYRIAN GOLDEN HAMSTERS AFTER INTRATRACHEAL INSTILLATION OF BENZO(A)PYRENE. 1. MORPHOLOGICAL STUDIES FROM SEMITHIN SECTIONS. *Zentrabl. Bakteriol. Hyg., Infectionskr. Abt. Orig. B, 159(5-6):493-502, 1974. 7 refs.*

Syrian golden hamsters were treated intratracheally with 0.63 mg benzo(a)pyrene once weekly for life. Pathological changes occurring in the bronchi were examined trom the 4th to the 21st wk after beginning B(a)P treatment. All morphological studies were performed from semithin sections which allowed for exact orientation of tissues. The development of bronchogenic adenomata from the earliest stage of slight cell proliferation to distortion of the basement membrane, growth of epithelial cords of cells into the lung tissues proper, and finally formation of the tumor are demonstrated.

49296 **APTIC NO. 71435**

Reznik-Schueller, Hildegard and Ulrich Mohr

INVESTIGATIONS ON THE CARCINOGENIC BURDEN BY AIR POLLUTION IN MAN. X. MORPHOLOGICAL CHANGES OF THE TRACHEAL EPITHELIUM IN SYRIAN GOLDEN HAMSTERS DURING THE FIRST 20 WEEKS OF BENZO(A)PYRENE INSTILLATION: AN ULTRASTRUCTURAL STUDY. *Zentralbl. Bakteriol. Hyg., Infektionskr. Abt. Orig. B, 159(5-6):503-525, 1974. 10 refs.*

Epithelial alterations occurring in the trachea of Syrian golden hamsters treated once weekly for life with 0.63 mg benzo(a)pyrene were examined by electron microscopy during the first 20 wk. The ultrastructural features in the change from normal epithelium to hyperplastic and then squamous metaplastic epithelium and finally to papillomata are described. The keratinizing process of epithelium undergoing metaplasia after B(a)P treatment corresponds to thy pattern described for the postnatal development of soft keratin in the skin of normal rats.

49297 **APTIC NO. 71463**

Ryzhkovsky, V. L., Y. V. Elfimova, and M. I. Gusev

THE RESORPTIVE ACTION OF SMALL CONCENTRATIONS OF METAL NICKEL AEROSOLS ON THE BODY. *(Rezorptivnoye deystviye malykh kontsentratsiy aerozolya metallicheskogo mikelya no organizm). Text in Russian. Gigiena i Sanit., no. 11:8-13, 1974. 16 refs.*

The action of metallic nickel aerosols was studied in male albino rats exposed to 0.5-0.005 mg/cu m concentrations for 3 mo. A significant increase in the latency time of reflexes; a transitory increase in the coproporphyrin level of the urine; an initial reduction and final increase in the arterial pressure; a significant increase in the number of altered luminescent leukocytes during the first and second months of the experiment; an initial reduction in the erythrocyte count and hemoglobin level, followed by an increase by the end of the experiment; and a significant increase in the serum arginase activity were observed. Exposure to 0.5 mg/cu m caused a slight increase in the catalase activity. Temporary reduction of the serum albumin level was observed. A significant increase in the bromosulphthalein retention in the liver, as well as the irritating and toxic effect of nickel on the respiratory organs, liver, kidney, spleen, and brain were noted. A correlation was established between the ambient concentration of nickel and the nickel contents of the lungs, spleen, and kidney.

49298 **APTIC NO. 71448**

Savchenko, M. F.

THE EFFECT OF HYDRAZINE ON THE INTRAUTERINE DEVELOPMENT OF THE EMBRYO. *(Vliyaniye gidrazina vnutiutrobnoye razvitiye ploda). Text in Russian. Gigiena i Sanit., no. 10:23-25, 1974. 3 refs.*

The embryotoxic effect of hydrazine was studied in pregnant rats inhaling hydrazine vapors during their pregnancy. Exposure to 1-6 mg/cu m concentrations caused increased embryonic mortality, resorption, and marked underdevelopment of live embryos which showed anemia and focal hemorrhages. The embryotoxic effect of hydrazine was most pronounced on the 10th day of pregnancy. The threshold concentration of hydrazine with respect to embryotoxicity is set at 0.1 mg/cu m for animals exposed during their entire pregnancy, and at 1 mg/cu m (equaling the maximum allowable concentration in workplace air) when the animals are exposed during the first half of their pregnancy. The pronounced embryotoxic effect of hydrazine calls for an increase in the safety margin, i.e., for a reduction of the maximum allowable concentration.

49299 **APTIC NO. 71089**

Sawatari, I., H. Chiba, K. Ootsu, Y. Yonebayashi, S. Odani, K. Yamamoto, S. Shiobara, and O. Shibuya

EFFECTS OF AIR POLLUTION ON THE INHABITANTS OF MEDIUM AND SMALLER CITIES: PART 4: HEALTH INVESTIGATION OF DISTRICT INHABITANTS. *(Chu-sho toshi ni okeru taiki osen no jumin no kenko ni ataeru eikyo (sono 4) chiiki jumin no kenko chosa). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health), 21(10):Suppl.:432, Oct. 1974. Presented at the Japanese Society of Public Health, 33rd Annual Meeting, Fukushima, Japan, Oct. 16-18, 1974.)*

Health disturbances and diseases of schoolchildren and their families in the suburbs of Tokyo were analyzed. The results were compared to their recognition of air pollution and the children s experience of asthma. There was a significant relationship between complaints of suffering from smokes and gases and the positive answer of children s asthma and health disturbance.

49300 **APTIC NO. 70952**

Sebayashi, T., Y. Okamoto, K. Ozaki, and T. Tsukamoto

INVESTIGATION OF RESPIRATORY RESISTANCE OF SCHOOLCHILDREN AND AIR POLLUTION, PART II. *(Gakudo no kokyu teiko chosa to taiki osen (dai 2 ho)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):325, Nov. 1974.*

An investigation of respiratory symptoms of schoolchildren was carried out by mass examination with survey of subjective symptoms and respiratory function test by respiratory resistance. Seemingly due to the season of examination, the number of children claiming cold, cough, and sputum was smaller than that in a previous survey When the respiratory resistance and body height were taken as parameters to make a regression curve, and those who showed a greater value than the standard deviation were taken as not healthy, the percentage of not healthy children in every school was 12-26. A relationship was recognized between the respiration resistance value (cm H2O/l/sec) and the concentration of sulfur oxide (PbO2 method) in air.

49301 **APTIC NO. 70953**

Sebayashi, T., Y. Okamoto, K. Ozaki, and T. Tsukamoto

RELATIONSHIP BETWEEN SUBJECTIVE SYMPTOMS OF SCHOOLCHILDREN DUE PHOTOCHEMICAL SMOG AND THE CONCENTRATION OF AIR POLLUTANTS. *(Kokagaku sumoggu ni yoru gakudo no jikakushojo chosa to taiki osen busshitsu nodo tono kankei (sono 2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):317, Nov. 1974.*

In Kobe City the first occurrence of damage seemingly due to photochemical smog was noticed in three middle schools in 1972. In a middle school in which pupils were damaged two times in Sept. 1972 and July 1973, 50 pupils playing tennis were examined for respiratory function, and environmental conditions were determined in the playground of the school. Although the concentration of primary air pollutants was higher than that of the previous year, that of oxidant was lower and lower than the standard. The resistance of respiration of pupils damaged was higher than that of those not damaged, irrespective of sex. The relationship between the resistance of respiration (cm H2O/l/sec) and the body height was the same as that obtained in the previous year.

49302 **APTIC NO. 71322**

Seki, H., H. Maeda, G. Ohi, and H. Yagyu

EFFECT OF LEAD ACETATE ON LEARNING AND MEMORY IN RATS. *(Namari no ratto gakushu noryoku no oyobosu eikyo). Text in Japanese. Tokyo-Toritsu Eisei Kenkyusho Kenkyu Nenpo (Annu. Rept. Tokyo Metrop. Res. Lab. Public Health), no. 25:381-384, 1974. 27 refs.*

To study the mental effects of exposure to lead, especially in auto exhaust in the ambient air, adult female Wistar rats were orally dosed with lead acetate at 125 mg(Pb)/30 g food for 6 weeks from the 3rd day of pregnancy to the 3rd week after delivery. Nine week-old male rats were examined as to learning and memory ability using a labyrinth in comparison to the ability of control rats. No significant deterioration of these abilities which might have been caused by exposure to lead in the rats early life stage was noted, although the mothers were given the maximal dose of lead they and the fetuses could tolerate.

• **49303** **APTIC NO. 71033**

Sellakumar, Arthur and Philippe Shubik

CARCINOGENICITY OF DIFFERENT POLYCYCLIC HYDROCARBONS IN THE RESPIRATORY TRACT OF HAMSTERS. *J. Nat. Cancer Inst., 53(6): 1713-1719, Dec. 1974. 30 refs.*

The respiratory tracts of male Syrian hamsters were exposed to different polycyclic hydrocarbons at various concentrations via multiple intratracheal instillations. Dibenzo(a,i)pyrene was the only compound tested which showed carcinogenic effects in the respiratory tract. Respiratory tract tumors were observed in 16 of 34 hamsters receiving 8 mg of the carcinogen and in 39 of 44 hamsters receiving 12 mg DB(a,i)P. More than 50% of the tumors in the latter group were squamous cell carcinomas. The first tumor was observed at 27 weeks after treatment. Most tumors in both groups arose from the epithelium of the bronchi and trachea. Dibenzo(a,i) pyrene appears to be a more potent carcinogen in the respiratory tract than benzo(3-4)pyrene based on results obtained with the latter in previous experiments. (Author abstract modified)

49304 **APTIC NO. 71475**

Senda, T. and M. Kawamori

THE ACTUAL STATE OF AUTOMOBILE NUISANCE AND ITS EFFECT ON INHABITANTS ALONG THE MAIN STREETS OF TOKYO. *(Toka kansen doro ni okeru jidosha kogai no jittai to jumin eno eikyo (dai Ippo)). Text in Japanese. Nippon Koshu Eisei Zasshi (Japan. J. Public Health), 21(10):Suppl.:441, Oct. 1974. (Presented at the Japanese Society of Public Health Annual Meeting, 33rd, Fukushima, Japan, Oct. 16-18, 1974.)*

In the surrounding area of the junction of the Central Highspeed Road and Koshu Road, the subjective symptoms and complaints of the inhabitants were collected and examined along with the result of determinations of carbon monoxide in the air. The daily motor traffic was about 60,000; the concentration of CO in the air was (max) 12 ppm (24 hr average) and 10 ppm five times a day; CO concentration was more than 5 ppm 75% of the day. The frequency of complaints of pain in throat, cough, sputum, colds, abnormal nasal feeling, lachrymation, and eye irritation were more than 50%, all of which were significantly higher than those in a control area.

49305 **APTIC NO. 71142**

Stebbings, James H., Jr.

FRACTIONAL CARBON MONOXIDE UPTAKE IN AN EMPLOYED POPULATION. *Thorax, 29(5):505-510, 1974. 27 refs.*

Fractional carbon monoxide uptake in 913 New York City transit workers was investigated as a possible index of pulmonary diffusing capacity for clinical evaluations, respiratory screening programs, and epidemiological studies. Age, standing height, body weight, race, and smoking habit variables were tested for their effect on fractional CO uptake. A prediction equation for white males, based on nonsmokers was derived in terms of age and body weight (CO uptake equals 0.58032 minus 0.00204 times age plus 0.0004 times body weight in kg). Weight was the body size index most strongly correlated with fractional CO uptake. Although there was little difference between smokers and nonsmokers at age 30, fractional CO uptake in smokers at the age of 60 was lowered by about 10% compared to nonsmokers. A correction factor for respiration based on tidal volume studies of 581 workers was also obtained and equalled minus 0.123654 times the difference between standard tidal volume and observed tidal volume. Tidal volume was the most important contributor to individual variability in the fractional uptake of CO; minute volume or respiration rate did not significantly add to it. Prediction equations for the fractional uptake of CO uptake corrected to 0.5 l tidal volume were derived for epidemiological or screening uses. Respiration variables explained only 1.5% of the individual variability which over a mean period of 16.6 months was much larger than the unexplained population variability (0.07 versus 0.01-0.02, respectively). The usefulness of fractional CO uptake as a test of respiratory function was thus questionable. (Author abstract modified)

49306 **APTIC NO. 70439**

Stewart, David J.

TEETH AS INDICATORS OF EXPOSURE OF CHILDREN TO LEAD. *Arch. Disease Childhood (London), 49(11):895-897, 1974. 3 refs.*

Deciduous molars, extracted from a total of 310 children aged between 3 and 10 years who resided in urban, suburban, and rural environments in Northern Ireland were analyzed for lead by atomic absorption spectrophotometry. Tooth lead content increased with age and was influenced by the nature of the donor s environment. Lead concentrations were greatest in the teeth of children in the urban group and least in the rural group, with suburban specimens intermediate. Deciduous teeth, available in quantity due to the high prevalence of dental caries, can conveniently be used as indicators of past exposure of children to lead contamination. The analytical method is suitable for use on a sufficient scale to enable comparisons to be made between communities. (Author abstract)

49307 **APTIC NO. 70959**

Takemoto, Kazuo

ON THE LUNG DISEASES BY AIR POLLUTION, ESPECIALLY ON LUNG CANCER. *(Taiki osen ni yoru hai no byohen, tokuni haigan ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):140-142, Nov. 1974.*

Experimental injection of 0.5 mg of carbon powder and 2 mg of 3,4-benzpyrene into the lung (via nose) of 5-week old ICR mice was carried out to examine the morbidity of lung tumors showed that the simultaneous injection of carbon powder and 3,4- benzpyrene gave the highest onset of lung tumors, followed by the case when carbon powder was injected first and 3,4- benzpyrene was injected a week later. In the group injected only with 3,4-benzpyrene the onset was less frequent, and carbon powder itself did not cause lung tumors. From these results it is not conceivable that carbon powder alone as an air pollutant in the lung causes anthracosis. The powder probably carries carcinogenic hydrocarbons (due to its strong adsorbing power) into the lung and allows them to remain there for a long time.

49308 **APTIC NO. 70734**

Takishima, T.

THE PROLEMS OF RESPIRATORY FUNCTION (9)-EVALUATION OF AIR POLLUTION AND DISTURANCE OF RESPIRATORY FUNCTION - A REMARK OF THE CHAIRMAN OF THE SYMPOSIUM WITH THE AOVE TITLE. *(Kokyu kino no mondaiten (9) - Taiki osen to kokyu kino shogai no hyoka Shikai no Kotoba). Text in Japanese. Nippon Kyobu Shikkan Gakkai Zasshi (Japan. J. Thoracic Dis.), 12(10):555, Oct. 1974.*

There is a paradox between the necessity to establish the method of detecting disturbances of respiratory function and the necessity of elucidating the disturbances of respiratory systems damaged by air pollution. Of the possible and actual methods for examining disturbances of respiratory function such as spirography, 1-second rate, vital capacity, respiratory resistance by the oscillation method, respiratory resistance by body plethysmography, flow-volume curve, phenomenon of closing volume, the frequency-dependency of dynamic lung compliance, the frequency-dependency of intrapulmonary distribution of gases, gas-diffusion in the gaseous phase, and gases in blood four methods were adopted in the present symposium. The methods of approach to disturbances of respiratory function concerning air pollution are biological models formed by air pollutants, smoker model for simulating air pollution, and living body model selected from inhabitants in polluted district. The utility of these methods is described.

49309 **APTIC NO. 71045**

Teranishi, Kiyoshi

BIOLOGICAL TESTING METHOD FOR CARCINOGENIC SUBSTANCES IN ATMOSPHERE. *(Taiki-chu hatsugan busshitsu no seibutsugaku-teki kensaho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):136-137, Nov. 1974. 4 refs.*

By observing the number of colonies of rat Salmonella typhi his mutants mutagenically returned from his- to his + by the rat liver S-9 fraction which was activated in vivo by phenobarbital and or polycyclic aromatic hydrocarbons (PHA), it was found that seven PHAs showed a higher mutagenesis inducing activity than phenobarbital on the Salmonella typhi strains TA1537 and TA1538A, both of which were the frame-shift type. However, the enzymes in the rat liver fraction S-9 induced only by PHA (dibenzo-a,k- anthracene) showed a high specificity on BAH. There was a quantitative relationship between the carcinogenicity of PAH and its mutagenic activity (when used with phenobarbital on Salmonella typhi TA1538A strain of his- mutant) on Salmonella typhi his - mutant TA1538A. Studies are underway on the quantitative determination of the carcinogenicity of the benzene-soluble fraction of air pollutants. It is not clear whether air pollutants are mutagenic to Salmonella typhi base-substituted mutant strains.

49310 **APTIC NO. 70662**

Thieme, R., P. Schramel, . J. Klose, and E. Waidl

THE INFLUENCE OF ENVIRONMENTAL FACTORS UPON TRACER ELEMENTS OF THE PLACENTA. *(Der Einfluss regionaler Umweltfaktoren auf die Spurenelement-Zusammensetzung der Plazenta). Text in German. Geburtsh. Frauenheilk. 34(1):36-41, Jan. 1974. 9 refs.*

The content of several heavy metals in placental tissue collected at different avarian areas by atomic absorption spectrometry was examined. The concentrations of elements like lead, cadmium, and chromium in placental tissue showed a statistically significant increase at Altoetting, Munich, and ayerischer Wald, where the tissues were evaluated. A somewhat higher concentration of lead occurred in the placental tissue at ayerischer Wald, apparently due to the intake of water and food containing heavy metals; in the area around Munich, incorporporation of heavy metals into the placenta was predominantly due to the inhalation of exhaust gases. The similar significantly higher content of copper in placental tissue at ayerischer Wald apparently was caused by a compensation of the organism, and therefore elements like manganese, aluminum, and iron did not show any difference.

49311 **APTIC NO. 70485**

Thomas, John A.

ACTIONS OF PESTICIDES AND OTHER DRUGS ON THE MALE REPRODUCTIVE SYSTEM (FINAL REPORT). *West Virginia Univ. Medical Center, Morgantown, W. Va., Environmental Protection Agency Grant R801650, ROAP No. 21AYL, Program Element 1EA078, Rept. EPA-650/ 1-74-011, 42p., Dec. 1974. 39 refs.*

NTIS: PB 237381/AS

Various oral doses of chlorinated hydrocarbon and organophosphorus pesticides, carbamate pesticides, and thiophanate fungicides were administered to mature male Swiss- Webster mice to assess the effects of the compounds on the male reproductive system. Administration of dichlorodiphenyltrichloroethane (DDT) in amounts ranging from 12.5-50 mg/kg resulted in altered testosterone metabolism in the prostate gland and the liver regardless of the dose. Tritium- labeled DDT administration led to the detection of significant amounts of tritium in male reproductive organs. Dieldrin caused significant alterations in the assimilation and metabolism of tritium-labeled testosterone in sex accessory organs and in hepatic microsomes of the rodents. The chlorinated hydrocarbon herbicide 2,4,5-trichlorophenoxy acetic acid was effective in altering the metabolism of androgens in male reproductive organs but had little effect upon the hepatic microsomal metabolism of androgens. Unlike the organochlorine-type compounds, carbaryl failed to alter androgen metabolism. The administration of radiocarbon-labeled carbaryl led to detectable amounts of radioactivity in several organs of reproduction including the seminal vesicles, prostate gland, and testes; low concentrations of the labeled carbamate and/or its radiometabolites were detected in the seminal plasma of the male mouse. Administration of the organophosphate parathion did not produce any significant changes upon the uptake and/or metabolism of androgens by sex accessory organs of the mouse. The fungicides thiophanate and thiophanate-methyl displayed no effect on spermatogenesis or androgen metabolism, though these agents did increase the weights of the adrenal gland. (Author abstract modified)

49312 **APTIC NO. 71365**

Tsukamotao, Nobuhiro

OPERATIONAL MANAGEMENT IN HANDLING OF ORGANIC SUBSTANCES, PART 1. *(Yukibutsu toriatsukai no sagyo kanri). Text in Japanese. Toso to Toryo (Finish Paint), no. 8:60, 1974.*

The management of substances commonly used in industries is discussed in terms of their flammability conditions, their effects on human health, recent industrial accidents and treatment of injuries. The substances selected and their permissible levels for human epxosure are: acetone (1000 ppm), aluminum, isophorone (25 ppm), chlorinated diphenyls (0.5 mg/cu m), gasoline (2000 mg/cu m), methyl acetate (200 ppm), thinner (200 ppm), and styrene monomer (100 ppm).

49313 **APTIC NO. 71478**

Tsukamoto, S. and S. Serizawa

AIR POLLUTION AND SYMPTOMS OF COMMON COLD AMONG INFANTS (INCLUDING THE PROPOSAL OF ENVIRONMENTAL STANDARD OF AIR POLLUTION). *(Taiki-osen to nyu-yo-ji no kaze shojo ni tsuite (kankyo kijun e no shiron o fukumete). Text in Japanese. Nihon Shonika Gakkai Zasshi (Soc. Paediatr. Jap.), 78(11):925, Nov. 1974.*

Symptoms of common cold such as rhinitis, stridor, and cough were examined daily on a total of 30,357 infants (140 per day) younger than 3 years for 1 year beginning Nov. 1972 in Osaka Prefecture. The year s average morbidity was 42% (38% in zero year infants and 44% in infants from 1 to 3), with a close correlation between monthly average morbidity and monthly averages of nitrogen dioxide and sulfur dioxide in Osaka air. In a day nursery where more than 20 infants could be observed, the correlation coefficient between the morbidity and concentration of SO2 and NO2 in air was 0.82 on a monthly basis and 0.59 on weekly basis. The correlation coefficient between the morbidity and SO2 concentration was 0.61 even in the area where SO2 concentration was lower than the national standard (lower than 0.04 ppm, 24-hour average), suggesting that the national standard of SO2 in air was not appropriate in protecting the infantile respiratory system.

49314 **APTIC NO. 71467**

Yamagiwa, H.

AUTOPSY CASES IN AIR POLLUTED AREAS OF YOKKAICHI AND THE PATHOLOGICAL EXAMINATION ON EXPERIMENTALLY BRED RABBITS. *(Yokkaichi taiki osen chiiki ni okeru bokenrei to jikkenteki shiiku kato no byorigakuteki kento). Text in Japanese. Nippon Rinsho (Japan. Clin.), 32(12):3596-3603, Dec. 1974. 12 refs.*

Pathological findings on eight cases of asthmatic paroxysm in Yokkaichi collected during 6 years from 1964 are described. Rabbits bred in the air polluted area of Yokkaichi for 10 months were also pathologically examined. The most important effect of Yokkaichi air pollution was the onset of chronic bronchitis and bronchial asthma, and one of the intermediary stages between such diseases and pulmonary emphysema is bronchiolitis. Effects of air pollution include inflammatory changes due to direct chronic stimulation of the pharynx, airway, and stomach; secondary changes in the immunological mechanism by repeated attack by air pollutants; disturbances due to translocation of pollutants and their derivatives into the blood; and histological disturbances due to pulmonary alteration of circulating and ventilatory functions.

49315 **APTIC NO. 70720**

Osaka Prefectural Inst. of Public Health (Japan), Lab. of Public Health

EFFECT OF OZONE-EXPOSURE ON THE INFECTION OF INFLUENZA VIRUSES ON MICE. *(Infuruenza birusukansen ni taisuru ozon bakuro no eikyo showa 47 nendo). Text in Japanese. In: Kokagaku Sumogo ni Kansuru Chosakenkyu No. 1 Osaka-fu, 1974. p. 315-318, Feb. 1974.*

After 1 day of exposure of 4 week old mice to ozone at 3 ppm for 2 hr, two varieties of influenza virus, A/Okuda/57 and A/FMI/47, were introduced, and the survival percentage of inoculated mice was observed after 2 weeks. The secreted substances were collected from the exposed and the unexposed mice, and the components were determined by disc-electrophoresis and immuno- electrophoresis. The lung washings of ozone-exposed mice contained serum protein components. The proliferation of a weakly pathogenic virus, A/Okuda/57 in the lungs of ozone-exposed mice was the same as that in the lungs of nonexposed mice. No difference of mortality was observed by the strongly pathogenic virus, A/FMI/47, between ozone-exposed mouse and nonexposed mice. A fluctuation of cross immunity between weakly and strongly pathogenic viruses was observed.

1973

49316 **APTIC NO. 71211**

Bianco, Andrea, F. R. Gibb, and P. E. Morrow

INHALATION STUDY OF A SUBMICRON SIZE LEAD-212 AEROSOL. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C. 1973, p. 1214-1219, 1974. 15 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2 TRACT

Purebred female beagle dogs of 10 kg were briefly exposed to a submicron aerosol of 212-lead having an effective diffusion diameter between 105-120 A. The resulting Pb burden was followed for up to 72 hr postexposure by external counting of the 240 kev gamma rays. The submicron aerosol of 212-Pb was cleared from the lungs with a single exponential process having a biological half-time of 12 hr. This mean value corresponds closely to the biological half-times in human lungs for 212-Pb and 210-Pb labelled aerosols of diverse physical and chemical forms, viz. 8-12 hr, suggesting that the clearance value can be generalized for atmospheric Pb. The blood is a principal clearance pathway and external assessment of radioactive Pb in the thorax must also consider the Pb content of the thoracic wall structures. (Author abstract modified)

49317 **APTIC NO. 71214**

Cuddihy, R. G., W. C. Griffith, and B. B. Boecker

BIOLOGICAL MODELING FOR PREDICTING RETENTION PATTERNS OF INHALED CONTAMINANTS. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1243-1248, 1974. 5 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

Biomathematical models were developed for simulating the tissue distribution and clearance of inhaled barium and cerium aerosols in Beagle dogs. Incorporating physical size characteristics of particles for predicting deposition and chemical solubility for estimating systemic absorption, application of these models was studied over a broad range of aerosol forms. The importance of determining these aerosol characteristics to aid in developing well founded predictions for its biological behavior is illustrated. Present procedures are more reliable in describing Ba metabolism and illustrate the more complex biochemical nature of Ce retention. (Author abstract modified)

49318 **APTIC NO. 71215**

Hewitt, P. J.

DEPOSITION AND ELIMINATION OF IRON OXIDE AEROSOL FROM THE LUNG OF RATS: COMPARISON WITH ICRP PREDICTIONS FOR MAN. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1249-1254, 1974. 9 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

Male albino rats were exposed to iron oxide aerosol (median aerodynamic diameter 0.3 micrometer) at iron concentrations up to 700 micograms/cu m for continuous periods up to 235 min, and for intermediate periods of 30 min over a 10-day period. From 0.3-3.0 micrograms of deposited iron were found in the rat lungs removed 1 day past exposure. This corresponds to initial pulmonary fractional deposition of between 0.3 and 0.7 which is comparable to that proposed for man for the ICRP Lung Dynamics Task Group (0.35). The elimination of deposited Fe from the rat lung can be described by a two component exponential expression with parameters similar to those of ICRP for man except that the phase two clearance in rats was shorter (T1/2 equals 33d). (Author abstract modified)

49319 **APTIC NO. 71217**

Holtzman, R. B., H. Spencer, F. H. Ilcewicz, and L. Kramer

METABOLIC BALANCES OF 210PB AND 210PO IN UNEXPOSED MEN. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1406-1411, 1974. 21 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

The metabolic balances of 210lead and 210polonium were measured in each of 12 men maintained on a metabolic ward. These nuclides were determined in urine and feces from each subject collected for at least 1 mo. Representative diets, drinking water, and atmospheric levels in the ward were also sampled. The mean levels (+ or - SE) were for 210Pb and 210Po, respectively, in diets over a period of 5 mo (1.2[illegible] + or - 0.04) and (1.63 + or - 0.05) pCi/day; in urine (0.275 + or - 0.026) and (0.269 + or - 0.033) pCi/day; and in feces (1.333 + or - 0.062) and (1.89 + or - 0.10) pCi/day. The mean overall balances (the difference between diet and excreta) of (-0.235 + or - 0.075) pCi 210Pb/day and (-0.337 + or - 0.100) pCi 210Po/day show that over the collection period, larger amounts were excreted than taken in the diet. Atmospheric intake accounts for an additional 210Pb intake of 0.07 pCi/day, but it contributes a 210Po intake of only about 0.02 pCi/day. The contribution of cigarette smoke and dietary levels of calcium to the balances is discussed. (Author abstract)

49320 **APTIC NO. 71240**

McIntire, Matilda S., Gerald L. Wolf, and Carol R. Angle

RED CELL LEAD AND DELTA-AMINO LEVULINIC ACID DEHYDRATASE. *Clin. Toxicol., 6(2):183-188, 1973. 12 refs.*

Heparinized venous blood samples were collected from 32 nursing and medical students (ages 18-28 yr), 10 urban black school students (ages 5-15 yr), 32 male battery workers, and 16 lead refinery workers to examine the relationship between red cell lead values and delta-aminolevulinic acid dehydratase values. Erythrocyte lead levels for the above groups were respectively: 24.25 + or - 1.3, 41.9 + or - 1.5, 102.7 + or - 4.9, and 135 + or - 5.2 micrograms/100 ml. Additionally, red cell levels for 43 garbage men not assayed for the ALAD enzyme were found to be 53.5 + or - 1.9 micrograms/100 ml. Red cell level showed a negative linear correlation with the logarithm of the ALAD activity among individuals with red cell leads ranging from 6 to 162 micrograms lead/100 ml red cells. There appears to be a more direct statistical correlation of cellular enzyme activity with cellular lead than with whole blood lead.

49321 **APTIC NO. 71483**

Noushi, H.

HEALTH INJURIES DUE TO PHOTOCHEMICAL SMOG: STUDIES BY THE TOKYO METROPOLITAN INSTITUTE OF PUBLIC HEALTH. *(Kokagaku smog hitai: Shotai o ou Tokyo-to Eiken no shigoto). Text in Japanese. Konnichi no Igaku (Med. Heute), no. 53:67-73, 1973. 2 refs.*

The first air pollution episode due to photochemical smog on July 18, 1970, is described with reference to human health effects. Symptoms such as dyspnea, numbness in extremities, and pharyngeal, ocular, laryngeal, and tracheal irritation, correlate with an oxidant level of 4.7%; morbidity of these symptoms correlates to both oxidant and sulfur dioxide levels of 27.3%, and to sulfur dioxide only at 23.3%. The symptoms which were not recognized as typical of the Los Angeles type photochemical smog which consists of oxidants, sulfur dioxide, and ambient temperature.

49322 **APTIC NO. 71212**

Ramu, M.-C. Subba

THE EFFECT OF BREATH-HOLDING ON THE DEPOSITION OF HALF-MICRON AEROSOL PARTICLES IN THE HUMAN LUNG. *International Radiation Protection Assoc., Oak Ridge, Tenn., Proc. Int. Radiat. Prot. Assoc., Int. Congr., 3rd, Washington, D. C., 1973, p. 1220-1225, 1974. 7 refs. (Sept. 9-14.)*

NTIS: CONF-730907-P2

Measurements of deposition of particles in the human lung during breath-holding were used to calculate the diameter of the tubular passageways of the respiratory tract in life. When the inspired volume is sufficiently great for most of the aerosol to penetrate beyond the anatomical dead space, the rate of deposition during the breath-holding can be regarded as an index of the average diameter of the alveolar airways. Studies of the effect of breath-holding on deposition and recoveries of 0.5 micron particles of unit density in different lung volumes are described. The average diameter of the airways in the alveolar region of the lung is 0.74 mm. (Author abstract modified)

1972

49323 **APTIC NO. 71204**

Bykhovskiy, A. V., O. M. Zarayev, and B. N. Rakhmanov

ESTIMATING THE PRECIPITATION OF RADIOACTIVE AEROSOLS IN THE REPIRATORY SYSTEM. *(K otsenko osazhdeniya radioaktivnykh aerozoley v dykhatel noy sisteme). Gigiena i Sanit., vol. 37:46, Sept. 1972. 10 refs. Translated from Russian. Scientific Translation Service, Santa Barbara, Calif., 8p. (HS-55)*

A method for estimating the accumulation of radioactive aerosols in the respiratory system of workers occupationally exposed to such conditions is described. The method utilizes a six-stage impactor such that the data obtained characterizes the distribution of aerosol radioactivity directly, i.e., by the aerodynamic diameter of the particles. A pulmonary dynamics model in conjunction with a logarithmic normal characterization of radioactivity distribution is used to determine the relative portion of radioactive aerosol retained in different sections of the respiratory tract (nasopharynx, tracheo-bronchial section, and lower section of the lungs). Coefficients of the retention of radioactivity, calculated with a logarithmic normal distribution and the aid of a linear programming method are given in tables. If aerosol radioactivity is more or less equally distributed throughout a controlled room, then readings from a stationary or portable aerosol sampler can be accepted as a satisfactory estimate of the true concentration and physicochemical properties of radioactive particles in air breathed by working personnel.

49324 **APTIC NO. 71205**

Fel dman, N. G.

NEUROHISTOLOGICAL METHODS IN HYGIENIC STANDARDIZATION. *(Neyrogistologicheskie metody pri gigienicheskom normirovanii). Gigiena i Sanit., no. 4:86-88, April 1972. 7 refs. Translated from Russian. Scientific Translation Service, Santa Barbara, Calif., 5p. (TR-274)*

Histological methods for assessing the effects of various neurotoxic agents on the nervous system were investigated in a series of experiments with laboratory animals. Studies of the inhalation effects of aliphatic alcohols (decyl, octyl, methyl, nonyl, and hexyl) on 66 rabbits showed that the greatest changes were found in the path of the visual analyzer (retina, optic nerve, chiasm, optic tract, superior colliculus, external geniculate bodies, and visual area of the cortex). The part of the visual analyzer which lacks neurons yielded most easily to neurohistological study. The method was verified with experimental data on the effects of methanol (peroral, inhalation, and complex) on 36 rats. Studies on the effects of butyl alcohol, a substance with a sharp unpleasant odor, were concentrated on the olfactory analyzer of rats. Neurohistological examination showed that butyl alcohol selectively damaged the olfactory analyzer, with less severe changes being observed in other afferent systems and nuclei of the brain. The effects of formaldehyde, a substance with a specific effect on the visual analyzer and an unpleasant irritating odor, were histologically verified also, with the optic nerve, chiasm and olfactory tract being the most affected areas. The study of specific portions of the nervous system can be used to standardize certain toxic neurotropic substances.

49325 **APTIC NO. 71209**

Zhukov, N. A. and T. S. Bakhina

PATHWAYS AND SIGNIFICANCE OF REDISTRIBUTION OF ZINC IN PATIENTS WITH CHRONIC PANCREATITIS. *(O putyakh i zhachenii pereraspredeleniya tsinka u bol nykh khronicheskim pankreatitom). Terapevt. Arkh., vol. 44:64-65, 1972. Translated from Russian. Scientific Translation Service, Santa Barbara, Calif., 4p. (TR-717-73)*

Blood analyses of zinc in 100 patients with chronic pancreatitis and 50 healthy volunteers were performed to investigate differences in the metal s distribution among the two groups. Zinc was significantly increased in the blood of patients with chronic pancreatitis, with erythrocyte concentrations being higher than normal and blood plasma concentrations being lower than normal. The influence of zinc in erythrocytes on carbohydrate metabolism was studied by subjecting 18 white rats to hemolysates obtained from patients with chronic pancreatitis. All of the rats showed a pronounced rise in blood sugar. Zinc apparently has the ability to complex with insulin and lower the latter s solubility, thus leading to incipient temporary hypoinsulinism and accompanying hyperglycemia. The redistribution of zinc in patients with chronic pancreatitis appears to be a compensatory phenomenon. As the condition of the patient improves under the influence of treatment, the level of plasma zinc rises.

1971

49326 **APTIC NO. 71199**

Battigelli, M. C., D. A. Fraser, and H. M. Cole

EXPERIMENTAL STUDIES ON SULFUR DIOXIDE TOXICITY. *Preprint, American Medical Assoc., Chicago, Ill., 24p., 1971 (?). 22 refs. (Presented at the Air Pollution Medical Research Conference, New Orleans, La., 1970.)*

Various groups of rodents were exposed for periods up to 112 days, 12 hr/day, 7 days/week to 1 mg/cu m of inert dusts (graphite and calcium sulfate of respirable size) and/or 3 ppm of sulfur dioxide to investigate possible synergistic effects arising from such combinations. Ciliary activity and respiratory surface microflora were used as the main indicators of disturbed homeostasis of the respiratory surface. The ciliary activity of tracheal mucosa of rats and hamsters was not affected by any of the treatments used. The frequency of isolation of bacteria genera from the peripheral lung up to and including the lobar bronchi appeared to be depressed in hamsters exposed to the dust alone or to the dust in combination with SO2. Rats and hamsters responded consistently to the mixture of SO2 and dust, with comparable reductions in the frequency of bacteria isolates. These changes appeared to be rapidly reversible upon discontinuation of the experimental treatment. Body weight and organ to body weight ratios for liver and lung tissue were not affected by the treatment. The hypothesis that the inhalation of SO2 along with an inert dust promotes infection was not supported by the experimental findings. (Author summary modified)

49327 **APTIC NO. 71208**

Guenther, T. and F. Dorn

ZN TRANSPORT IN ASCITES TUMOR CELLS. *(Ueber den Zn-Transport bei Ascites-Tumorzellen). Z. Klin. Chem. Klin. Biochem. (Munich), vol. 9:438-442, Sept. 1971. 6 refs. Translated from German. Leo Kanner Associates, Redwood City, Calif., 11p., March 1972. (TR 445-73)*

The uptake and release of zinc-65 by Ehrlich mouse ascites tumor cells was studied using radioactive tracer techniques. The uptake and release of labelled zinc was independent of cell metabolism and increased linearly with extracellular Zn-65 concentration. The optimum pH of Zn uptake about 7.3, and the optimum temperature was 40 C. Sulfhydryl reagents increased the rate and uptake of labelled Zn; while metabolic poisons and strophthanthin, which specifically inhibits membrane-bonded sodium and potassium-activated adenosine triphosphatase and active Na-K transport, had no significant effect on Zn uptake. Zinc binding agents inhibited the metal s uptake in incubation media. The Zn absorbed by the cells appeared to be predominantly intracellular. The accumulation of Zn was attributed to complex formation within the cell.

49328 **APTIC NO. 70901**

Nieding, G. von, M. Wagner, H. Krekeler, U. Smidt, and K. Muysers

MINIMUM CONCENTRATIONS OF NO2 CAUSING ACUTE EFFECTS ON THE RESPIRATORY GAS EXCHANGE AND AIRWAY-RESISTANCE IN PATIENTS WITH CHRONIC BRONCHITIS. *(Grenzwertbestimmung der akuten NO2-Wirkung auf den respiratorischen Gasaustausch und die Atemwegswiderstaende des chronisch lungenkranken Menschen). Text in German. Int. Arch. Arbeitsmed., vol. 27:338-348, 1971. 27 refs.*

Nitrogen dioxide-air mixtures containing 0.5-5.0 ppm NO2 were inhaled by 88 patients with chronic bronchitis over a 15-minute period for a total of 30 breaths during studies investigating the effects of the gas on airway resistance and respiratory gas exchange. End-expiratory oxygen pressures remained nearly constant during inhalation of 4 or 5 ppm NO2, though significant decreases in arterial oxygen pressure accompanied by increases in end-expiratory-arterial oxygen pressure difference occurred. Inhalation of 2 ppm NO2 did not decrease arterial oxygen pressure. Airway resistances increased significantly down to 1.5 ppm NO2 concentrations. Lower concentrations caused no significant effects.

1970

49329 **APTIC NO. 71207**

Koval skiy, V. V., S. V. Letupova, and R. D. Altynbayeva

GENETIC TRANSFORMATION OF RESISTANCE TO SELENIUM AND FORMATION OF SELENIUM REDUCTASE IN BACILLUS MEGATERIUM. *(Geneticheskaya transformatisiya ustoychivosti k selenu i obrazovaniya selenreduktazy v Bacillus megaterium). Dokl. Akad. Nauk SSSR Mikrobiol., 194(6):1429-2432, 1970. 11 refs. Translated from Russian. Leo Kanner Associates, Redwood City, Calif., 10p., March 1973. (TR 491-73)*

An attempt to impart high selenium resistance to strain 101 of Bacillus megaterium (isolated from selenium-poor soil) was made by adding deoxyribonucleic acid from strain 8 (isolated from selenium-enriched soil) to the nutritive medium. The number of transformants obtained in this way (out of the overall number of cells) varied from 0.005 to 1.08%. Strain 101 transformants possessed a selenium-reducing capacity similar to that of the donor strain 8, though not to as great a degree. Different transformants possessed this capacity to different degrees. The regulation of the adaptability of Bacillus megaterium to a heightened soil selenium content and the formation of selenium reductase appears to be based on the genetic pecularities of the organism.

1969

49330 **APTIC NO. 71206**

Timini, G. P., C. Ferrari de Gaetani, and M. S. Saviano

HISTOMORPHOLOGICAL AND HISTOENZYMATIC MODIFICATIONS IN THE ADRENAL CORTEX OF RATS IN THE PRESENCE AND IN THE ABSENCE OF DIETARY ZN. *(Modificazioni istomorologiche ed isotoenzimatiche del corticossurrene di ratto in carenza ed in trattamento con zinco). Boll. Soc. Ital. Biol. Sper. (Naples), vol. 45:607-610, 1969. 12 refs. Translated from Italian. Scientific Translation Service, Santa Barbara, Calif., 10p. (TR-450-73)*

The influence of dietary zinc on the adrenal cortex of 94 Wistar rats divided into zinc-deprived and zinc-supplemented groups at different stages of growth was studied morphologically and histochemically. Adrenals from animals kept on a Zn-free diet since weaning showed definite signs of hypoplasis, while adrenals from a group treated with Zn over the same time period were considerably more developed even when compared with a control group. These size variations indicated a possible stimulating activity of Zn on the adrenal cortex. The hyperplasia and hyperfunctional aspects of the zona glomerulosa and fasciculata in all animals receiving Zn either since weaning or during adult life supported this interpretation. These results were also confirmed by increased enzymatic activities which were considered as positive evidence of adrenal cortex activity. Hypofunction of the zona fasciculata was observed together with hyperfunction of the zona glomerulosa in animals on a Zn-free diet. The Zn- free diet did not bring about hypofunction of the zona fasciculata in adult males, however. Zinc can influence the functioning of the adrenal cortex by either acting on the zona glomerulosa through an unknown mechanism or indirectly on the zona fasciculata, most probably through the hypothalamus-hypophysis.

EFFECTS-PLANTS AND LIVESTOCK

1975

49331 **APTIC NO. 70983**

Beavington, F.

SOME ASPECTS OF CONTAMINATION OF HERBAGE WITH COPPER, ZINC, AND IRON. *Environ. Pollut., 8(1):65-71, Jan. 1975. 12 refs.*

Samples of white clover and paspalum were taken from an industrial area (copper smelter and steel works) and a rural area of Australia and analyzed for copper, zinc, and iron contents. Mean levels of copper, zinc, and iron for all herbage collected in the industrial area were 38.0, 70.4, and 723 ppm as compared with levels of 9.8, 28.6, and 129 ppm, respectively, for the rural samples. Zinc and copper levels correlated significantly with distance from the smelter, and iron levels with distance from the steelworks. Higher concentrations of all three contaminants were found in white clover than in paspalum. (Author abstract modified)

49332 **APTIC NO. 70982**

Coulson, Christopher L. and Robert L. Heath

THE INTERACTION OF PEROXYACETYL NITRATE (PAN) WITH THE ELECTRON FLOW OF ISOLATED CHLOROPLASTS. *Atmos. Environ., 9(2):231-238, Feb. 1975. 25 refs.*

The interaction of peroxyacetyl nitrate with the electron flow of isolated spinach chloroplasts was studied by passing the gas through a 5-microliter pipette submerged in 1 cu cm of chloroplast suspension. The nitrate inhibited the electron flow in both Photosystem I (reduced indolphenol dye conversion to nicotinamide adenine dinucleotide phosphate) and Photosystem II (water conversion to indolphenol dye) of the isolated chloroplasts with no uncoupling (no increase in basal electron flow rate). Furthermore, PAN was relatively stable in solution (half life of 3 min), and thus the Hill reaction (ferricyanide reduction) rate continued to decline slowly after gassing. Dithiothreitol decomposed the PAN and eliminated this after-gassing decline effect, but it did not reverse the inhibition of the Hill reaction. Light stimulated the inhibition produced by PAN, but only in aged chloroplasts. (Author abstract modified)

49333 **APTIC NO. 71123**

Huckabee, John W. and S. A. Janzen

MERCURY IN MOSS: DERIVED FROM THE ATMOSPHERE OR FROM THE SUBSTRATE? *Chemosphere, no. 1:55-60, 1975. 12 refs.*

Laboratory and field experiments with the mat-forming moss Dicranum scoparium were conducted to substantiate that such plants, often used as indicators of airborne trace metals, acquire only insignificant or zero amounts of heavy metals from the soil substrate. Radiolabeled-mercury uptake tests with in situ mats of D. scoparium from soil confirmed that soil-bound mercury was not available for uptake, even though soil mercury was evidently mobile and leachable by ground water. However, in laboratory experiments, isolated D. scoparium gametophytes rapidly accumulated labeled mercury from solutions in which the rhizoids were immersed. The labeled metal was either absorbed at the rhizoids and translocated by the plant or was conducted upward by capillary action. Thus mercury ions dissolved in run-off water can accumulate in D. scoparium if the water contacts any part of the plant. The reduction and evolution of mercury in substrate is not an important source of mercury in moss, indicating that the heavy metal content of moss is derived mainly from the atmosphere.

49334 **APTIC NO. 70979**

Pahlich, E.

EFFECT OF SO2-POLLUTION ON CELLULAR REGULATION. A GENERAL CONCEPT OF THE MODE OF ACTION OF GASEOUS AIR CONTAMINATION. *Atmos. Environ., 9(2):261-263, Feb. 1975. 18 refs.*

The effect of sulfur dioxide and its derivatives on regulatory enzymes of amino acid metabolism in pea seedlings was investigated. The ratio of the inorganic to organic fraction of SO2 derivatives determined whether the effects of exposure were nutritional or damaging. Inorganic derivatives of SO2 exerted unspecific effects on regulatory enzymes and membranes, resulting in plant damage. Gaseous contaminants which can be transferred to organic metabolism or another sink (e.g., vacuoles) are less harmful than those which mainly exist as ions.

49335 **APTIC NO. 70984**

Pell, Eva J. and Eileen Brennan

ECONOMIC IMPACT OF AIR POLLUTION ON VEGETATION IN NEW JERSEY AND AN INTERPRETATION OF ITS ANNUAL VARIABILITY. *Environ. Pollut., 8(1):23-33, Jan. 1975. 33 refs.*

The economic impact of air pollution on vegetation in New Jersey was surveyed for the years 1971 and 1972. A loss of $128,019 was sustained in 1972 due to damage of agricultural crops and ornamental plantings exposed to air pollutants. Ozone accounted for 27% of the damage, peroxyacetyl nitrate for 20%, hydrogen fluoride for 18%, ethylene for 15%, sulfur dioxide for 4%, and ammonia for 1%. The loss was only 11% of that estimated for the previous year by a similar method despite the fact that air pollutant concentrations did not decrease from 1971 to 1972 in the agricultural regions during the growing season. An unusual rainfall pattern in 1972 possibly induced a water and/or oxygen stress in the plants such that they were protected from air pollution injury. Other factors such as temperature, humidity, nutrition, the presence of disease, and the use of systemic fungicides may also have enhanced plant resistance to air pollutants. (Author abstract modified)

49336 **APTIC NO. 71124**

Wedding, James B., Roger W. Carlson, James J. Stukel, and Fakhri A. Bazzaz

AEROSOL DEPOSITION ON PLANT LEAVES. *Environ Sci. Technol., 9(2):151-153, Feb. 1975. 9 refs.*

An aerosol generator and wind tunnel fumigation system was used to study particle deposition on plant leaves in a well defined flow field. Preliminary experiments with sunflower leaves indicated that uranine particles (6.77 micron diameter) can be substituted for lead chloride particles (3.36 micron diameter) in some aerosol deposition experiments. The former can be much more easily analyzed as opposed to lead aerosols. Experiments designed to investigate the effect of leaf surface characteristics on aerosol deposition showed that the deposition rate of uranine particles on rough pubescent leaves of the sunflower was 10 times that for glaborous tulip poplar leaves. Another set of experiments revealed that aerosol deposition, on a per unit area basis, for single horizontal streamlining leaves is similar to that for arrays of leaves under similar flow conditions.

49337 **APTIC NO. 70985**

Welch, W. R. and D. L. Dick

LEAD CONCENTRATIONS IN TISSUES OF ROADSIDE MICE. *Environ. Pollut., 8(1):15-21, Jan. 1975. 24 refs.*

Soil samples and seven different tissues from deer mice (Peromyscus maniculatus) were collected along a major highway and analyzed for lead content to determine whether lead accumulation occurs differentially in various tissues of small mammals as functions of traffic density and distance from the highway. Lead concentrations in the soil were related to proximity to the highway but not to traffic volume. Accumulation of lead in mouse liver, kidney, and bone, but not in brain, lung, stomach, and muscle, were related to both traffic volume and nearness to the highway. Median lead concentrations near a highway with a traffic density of 38,000 vehicles/mi ranged from 2.70 ppm for brain and muscle to 106.0 ppm for bone tissue. Thus deer mice appear to be sufficiently susceptible to existing environmental lead levels near highways to manifest different lead accumulations in various tissues.

1974

49338 **APTIC NO. 71024**

Hanson, George P., Daniel H. Addis, and Linda Thorne

SMOG-TOLERANT PETUNIAS DEVELOPED AT THE LOS ANGELES STATE AND COUNTY ARBORETUM. *Lasca Leaves, 24(4):117-119, Dec. 1974.*

The development of a smog-tolerant petunia known as LASCA PINK is described. The inbred parents of two smog-tolerant hybrids and two smog-sensitive hybrids were acquired and were crossed in all possible combinations. A large number of resultant seedlings were fumigated with ozone, and the 30 most tolerant plants were collected. Pollen was gathered from each plant, mixed, and used to pollinate stigmas from the same plants. Fertilization occurred, and the resulting seeds were collected and bulked for a second cycle of selection. Pollen was again collectd during the second cycle from about 30 plants which remained uninjured or only slightly injured after being subjected to ambient smog during their development. The pollen from these plants was mixed and applied onto the stigmas of the same smog-tolerant plants. Fertilization occurred, and the resulting seed, called LASCA PINK-2, was collected and bulked. A third cycle of selection was also performed to obtain a seed called LASCA PINK-3. The LASCA PINK-2 proved to be more smog-tolerant than any of 18 other varieties tested.

49339 **APTIC NO. 70345**

Honda, H.

TREE PLANTING AROUND FACTORIES AND THE SUITALE KINDS OF TREES FOR IT. *(Kojo ryokka to sono tekisei shokubutsu). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 10(5):1726-1730, May 1974.*

Many important factors affect plant damage including the nature of pollutants, the atmospheric conditions under which pollutants are emitted, the physiological conditions of plants, and the cultural conditions to keep the plants. In fact, the features of damage become extremely complicated by the combination of these factors. The mechanism of the occurrence of damage is as follows. Gaseous pollutants invade through stomata in epidermal tissue and part of them enters into the body through water pores situated at the point of leaves or in the leaf margin. Since the number of stoma is much greater than that of water pores, the amount of damage depends on not only the internal conditions of leaves, but also on the size, distribution, structure, and opening and closing of stoma. The symptoms of damage in plants are visible external changes and invisible internal changes. The resistivity of plants against pollution can be studied by two methods. One is the observation of plants in the laboratory, the other is actual research around polluted districts. The deciduous broad leaved group is much more sensitive than the evergreen broad leaved group.

49340 **APTIC NO. 70357**

Itai, K., F. Tsunoda, and S. Sakurai

ON THE DETERMINATION OF FLUORINE IN ROWN RICE. *(Genmai-chu fusso no teiryo-ho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):373, Nov. 1974.*

As the air pollution threat due to fluorine has increased, the content of fluorine in crops for food and feed has become important. Previous methods of determining fluorine in rice gave considerable fluctuation. A newly established method of fluorine determination in rice is therefore described. The route of analysis consists of keeping brown rice in calcium hydroxide for 24 hr, then evaporating it to dryness, and calcinating the rice in a crucible at 550 C. The ashes are added to concentrated sulfuric acid with a small amount of silver sulfate and aqua regia and steam-distilled at 137 + or - 5 C. The 10 ml aliquot of 250 ml of distillate was determined for fluoride ion by the fluoride ion meter. Recovery of fluorine was 92-103.2%.

49341 **APTIC NO. 70846**

MacLean, David C.

NITROGEN OXIDES AS PHYTOTOXIC AIR POLLUTANTS. *VDI (Verein Deutscher Ingenieure), Duesseldorf (West Germany), Komission Reinhaltung der Luft, In: Stichstoffoxide. Environmental Protection Agency Grant 801070, Rept. 61/657-HWS/Ni, p. 93-113, Sept. 1974. 34 refs.*

The phytotoxic effects of nitrogen oxides are reviewed. Although such effects are primarily indirect (via participation in photochemical reactions resulting in the production of atmospheric oxidants), plants in confined areas near nitrogen dioxide-emitting sources are susceptible to direct injury. The means by which NOx affect plants at the cellular level are not well understood; observations of NOx-exposed plants, however, reveal altered metabolism, ultrastructural changes in the chloroplasts, and reduced phtoosynthesis. There is no typical leaf symptom for diagnosing NO2 injury to plants, though the primary leay symptom of chronic NO2 exposure is chlorosis, which is unfortunately non-specific and thus a poor diagnostic criterion Acute injury to leaves of dicotyledonous plants is usually characterized by the rapid appearance of irregularly-shaped intercostal lesions that are usually indistinguishable from sulfur dioxide-produced lesions. Both stimulation and reduction of plant growth are reported for NO2 exposures. Factors affecting plant response to NOx exposure include: differences between species, varieties, cultivars, or even clones of the same species; the stage of plant development at the time of exposure; the age of the plant leaves; various environmental factors (light conditions, temperature, humidity); and the presence of other pollutants in the atmosphere.

49342 **APTIC NO. 71069**

Mutsuura, T. and Y. Hishiyama

EFFECTS OF AIR POLLUTION ON TREES IN YOKOHAMA. *(Jumoku no taiki osen ni yoru eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):352, Nov. 1974.*

The vitality of ginkgo, cherry, zelkova, platanus, and pine trees, and the content of sulfur and heavy metals in leaves of ginkgo and cherry trees at 10 places including gardens, streets, and schools in Yokohama and at one place remote from the city were surveyed in April, May, August, and November 1973. The vitality of trees in the city was inferior to that in control places, especially that of zelkova. The sulfur content in ginkgo leaves increased a little from May to August and rapidly from August to November, as contrasted to the small change in those in control places. The sulfur content in cherry leaves showed a decreasing tendency from May through August to November both in the city and in control places. The content of heavy metals (zinc, iron, copper, lead, nickel, and manganese) of ginkgo and cherry leaves was larger in trees in industrial zones of the city, especially for Zn, Cu, and Pb.

49343 **APTIC NO. 70340**

Ota, Y.

EFFECTS OF ETHYLENE AS AN AIR POLLUTANT ON PLANTS. *(Taiki osen busshitsu to shiteno echiren no shokubutsu ni oyobosu eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):374, Nov. 1974.*

Ethylene, which causes a variety of plant growth regulating actions, has recently been noticed as an air pollutant exhausted from factories and motor vehicles. The atmospheric concentration is very low, and it is very difficult to ascribe the plant damage to ethylene in the presence of many other air pollutants. However, considering the action of ethylene of a very minute amount, there is a possibility that the minute amount of ethylene in the atmosphere might have affected plant life, resulting in undesirable changes such as early leaf-fall, leaf-yellowing, abnormality and early drop of fruits, abnormal influorescence, and epinasty.

49344 **APTIC NO. 70746**

Pearson, R. G., D. . Drummond, W. D. McIlveen, and S. N. Linzon

PAN-TYPE INJURY TO TOMATO CROPS IN SOUTHWESTERN ONTARIO. *Plant Disease Rept., 58(12):1105-1108, Dec. 1974. 9 refs.*

Investigations of unusual foliar injury development on tomato crops on southwestern Ontario during 1972 and 1973 indicated widespread peroxyacetyl nitrate (PAN)-type injury on rapidly growing, succulent, middle-aged foliage of recently transplanted field tomatoes. The injury symptoms ranged from undersurface silvering, glazing, and bronzing to bifacial necrosis accompanied by leaf rolling. Histopathological examination revealed cellular injury only in the lower epidermis and adjoining spongy mesophyll layers. A review of weather records for locations in Ontario and to the south of lake Erie in Ohio showed that weather conditions were favorable for the formation and transport of photochemical oxidants monitored in industrial areas such as Cleveland prior to the development of tomato plant injury in Ontario. (Author abstract modified)

49345 **APTIC NO. 71078**

Shinozaki, M. and T. Hiratsuka

INVESTIGATION OF REAL STATE OF ENVIRONMENTAL POLLUTION BY ANALYSIS OF MULBERRY-LEAVES. *(So-yo bunseki ni yoru nokochi no kankyo osen no jittai). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):353, Nov. 1974.*

Mulberry tree was chosen as an index plant of air pollution, and the leaves were collected from 20 points in Kanagawa Prefecture in August 1972 and 1973, washed, air-dried, powdered, and analyzed. The average content of heavy metals was 126 ppm of iron, 31 ppm of zinc, 41 ppm of manganese, 8 ppm of lead, 5.3 ppm of copper, 2.6 ppm of nickel and 0.72 ppm of cadmium, without large local difference. The average content of sulfur was 1300-1400 ppm on the average, also without large local differences, however, the content of fluorine was only 8.6-8.8 ppm in the leaves of places remote from industrial districts as compared to the average of 13-14 ppm. The analytical values of sulfur and fluorine in leaves collected from four representative places (middle and north) showed a decreasing tendency from the middle- to the north parts of the Prefecture; in the north part of the fluorine content in leaves coincided to that in the air.

49346 **APTIC NO. 70776**

Takizawa, H.

LOCAL ENVIRONMENTAL CONTROL AND IOLOGICAL INDICATOR - AIR POLLUTION AND IOLOGICAL INDICATOR. *(Chiiki no kankyo kanri to seibutsu shihyo - taiki osen to seibutsu shihyo-). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 3(11): 803-812, Nov. 1974.*

Two sides of environmental control, the feed forward control and the system of environmental control utilizing feedback, are described with relation to biological indicators. As one of the factors in terrestrial ecological systems, the concentration of air pollutants was related to plant damage, referring to a result of a survey on the frequency of damaged plant (cryptomeria) versus concentration of sulfur dioxide, for several distances from the coast. The merits and the selection standards of a biological indicator are described in detail citing specified plant indicators to respective air pollutants such as SO2, hydrogen fluoride, nitrogen dioxide, ozone, peroxyacetyl nitrate, ethylene, chlorine, hydrogen chloride, ammonia, and photochemical oxidants. As general biological indicators, some insects, some amphibians, fishes, birds, mammals including mankind, and plants, can be used. In utilizing plants as an indicator of air pollution, the detailed standard items which represents the active status of the indicator plants were described.

49347 **APTIC NO. 70354**

Taniyama, T. and T. Watanabe

SYMPTOMS AND SUSCEPTIILITY OF PLANTS TO GASEOUS CHLORINE. *(Enso gasu ni yoru shokubutsu no higai shojo to sono kanjusei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 9(2):372, Nov. 1974.*

Symptoms of plants due to chlorine injury were divided into the following five groups: chlorosis or white to greyish- white discoloration on the apex or periphery of leaves of rice, wheat, and Alopecules; and reddish brown discoloration of the apex and iterveinal parts and leaf-fall in rice, Cryptotaenia, and Zelkova. The reddish brown spots on rice leaves are due to aqueous hydrochloric acid formed from chlorine and water droplets in air. The third group is brown black or black discoloration on the leaf periphery or interveinal parts of French bean. The last category is leaf-fall of seemingly uninjured leaves of cherry, Acer, and Xanthoxylum. The rate of appearance of injuries differed from plant to plant, 7-10 days in Acer and pines, and three days in French bean, rice, Allium, and Paeonia moutan.

49348 **APTIC NO. 71170**

Taylor, O. C.

MONITORING AND ATMOSPHERIC REACTION OF FLUOROCARBONS--FINAL REPORT. *In: Fluorocarbons - Impact on Health and Environment. 93rd Congress (House of Representatives), Second Session, Rept. H.R. 17577, H.R. 17545, Serial 93-110, p. 450-455, Dec. 11-12, 1974. 9 refs. (Hearings Before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce.)*

GPO

The monitoring, plant response, and atmospheric reactions of fluorotrichloromethane (fluorocarbon 11) and dichlorodifluoromethane (fluorocarbon 12) in the Southcoast Air Basin in California are described. Above 7000 ft the concentration of fluorocarbon 11 was between 0.04 and 0.06 ppb and the fluorocarbon 12 concentration was too low to measure with the equipment. At 57,000 ft fluorocarbon 12 concentration was 169 parts per trillion (ppt) and fluorocarbon 11 concentration was 69 ppt. Radish, tomato, and pinto bean plants fumigated for 20 days with about 25 ppb of fluorocarbon 11 showed no visible effects, and growth was not altered. Fumigation of pinto bean and barley plants for 17 days with 3 to 6 ppm fluorocarbon 12 produced no visible injury and no change in growth determined by fresh and dry weight. The addition of sulfur dioxide and nitrogen dioxide to polluted ambient air and mixtures of fluorocarbons did not aid in initiating photochemical reactions. The fluorocarbons penetrated into the soil atmosphere and concentrations changed in direct relationship with changes in concentration in the atmosphere above ground.

49349 **APTIC NO. 70752**

Vasiloff, G. N. and M. L. Smith

A PHOTOCOPY TECHNIQUE TO EVALUATE FLUORIDE INJURY ON GLADIOLUS IN ONTARIO. *Plant Disease Reptr., 58(12):1091-1094, Dec. 1974. 4 refs.*

A photocopy method was used for evaluating and reproducing fluoride-induced leaf injury during a gladiolus indicator plant program. Measurements of leaf injury and fluoride content were made on 5000 leaves from potted gladioli plants grown at 31 indicator plot locations in seven surveillance areas located in the Province of Ontario. Harvested plants were transported to a laboratory where a standard office photocopier was used to make reproductions of four middle-aged leaves from each plant. All leaves collected from each plot were divided into terminal and basal portions for chemical analysis of fluoride and other phytotoxic components. Comparisons of fluoride content and leaf injury for three collections of gladioli in a surveillance area near a fertilizer plant showed reductions in leaf injury which paralleled reductions in fluoride content for increasing distances downwind of the source. As the plot distance increased from 3.4 km to 5.5 km from the source, fluoride content decreased from 5.0 ppm to 3.0 ppm and leaf injury decreased from 4.6% to 0.2%.

49350 **APTIC NO. 71098**

Yamamoto, T., Y. Hirota, and E. Minakami

ENVIRONMENTAL POLLUTION EVALUATION OF FLUORINE COMPOUNDS BY INDEX PLANTS AND FLUORINE ANALYSIS. *(Shihyo shokubutsu niyoru kichu fussokabutsu no kankyo osen hyoka to sono bunsekiho no kento). Text in Japanese. Preprint, p. 9-10, 1974. (Presented at the Environmental Toxicology Symposium 1st, Osaka, Japan, Nov. 21-22, 1974, Paper 9.)*

The atmospheric pollution pattern by fluorine compounds was evaluated by index plants over a period of 8 yr. The growth and appearance of plants were analyzed in reference to F content in plants (on ground and potted), agricultural products, soil, subterranean water, and atmosphere. The sulfuric acid (with addition of sodium silicate)-steam distillation method was most effective for the determination of F in plant samples. The zinc oxide-sodium carbonate fusion method (sample: $ZnO:Na_2CO_3$ equal 1:2:3, 600-1000 C) was most effective for soil analysis. The F content in plant samples showed a decreasing trend over the years, and the radium of polluted areas decreased with time, reflecting the control measures taken over the past years. On the other hand, the atmospheric F concentration showed no significant decrease. No significant relationship was found between F content in plant and that in soil and subterranean water.

1973

49351 **APTIC NO. 70483**

Hawksworth, D. L., B. J. Coppins, and F. Rose

CHANGES IN THE BRITISH LICHEN FLORA. *Systematics Assoc. (England), Changing Flora Fauna Brit., Proc. Symp., Leicester, England, 1973, p. 47-77. 63 refs.*

Between the periods in which British lichens were studied most intensively, some drastic changes have taken place in the composition of the flora in some regions of the British Isles. Although only about 40 species (approximately 3% of the total flora) have not been refound in this century, many have disappeared from large areas of central and eastern England. The major factor causing this decline is pollution of the air by sulfur dioxide which has affected both the distributions of species and the floras of particular sites. Air pollution appears to have had an overriding effect, but in areas where this is not important, changes may also arise from bark eutrophication, agricultural sprays, maritime pollution, woodland management, quarrying and mining, changes in man-made substrates, heathland management, overcollecting, public pressure, and possibly water pollution and other organisms. Of these factors, woodland management has had the most deleterious effect, since many species are restricted to ancient woodlands. Recent climatic fluctuations appear to have had little effect on the British lichen flora. Unless trends in air pollution emissions are modified, a continuing depletion of lichen flora will occur, and many more species are likely to become extinct in Britain. Many small invertebrates live on and amongst lichens, so declining lichen vegetation is a matter of some concern to biologists generally and not only to lichenologists. (Author abstract)

49352 **APTIC NO. 70867**

Oshima, Ronald J.

FINAL REPORT TO THE CALIFORNIA AIR RESOURCES BOARD UNDER AGREEMENT ARB-287. DEVELOPMENT OF A SYSTEM FOR EVALUATING AND REPORTING ECONOMIC CROP LOSSES CAUSED BY AIR POLLUTION IN CALIFORNIA. I. QUALITY STUDY. *California Dept. of Food and Agriculture, Sacramento, Div. of Plant Industry, California Air Resources Board Contract ARB-287, 134p., July 31, 1973. 9 refs.*

The results of a study on the effects of oxidant air pollutants on crop quality in California are presented as part of an integrated program designed to develop a crop loss assessment methodology based on fumigation studies, field plots, and statistical methods. Long-term fumigation studies under greenhouse conditions were accurate in forecasting the expression of oxidant effects on crops during the quality study. Ambient ozone levels were statistically correlated to the incidence of irregular fruit produced by Tioga strawberries, and Boston leaf lettuce was susceptible to quality reduction by both ozone and peroxyacetyl nitrate. Other crops examined were not affected by these pollutants. Ozone fumigation reduced the yield of every row-crop studied. The PAN did not affect the quality or yield of Golden Jubilee sweet corn, H-11 tomato, Emperator 58 carrot, Cophenhagen cabbage, and Tioga strawberry. An air monitoring biological indicator system and a photo-reference system of plant injury evaluation proved effective in standardizing injury evaluations.

49353 **APTIC NO. 70847**

Rose, F. and E. C. Wallace

CHANGES IN THE BRYOPHYTE FLORA OF BRITAIN. *Systematics Assoc. (England), Changing Flora Fauna Brit., Proc. Symp., Leicester, England, 1973, p. 27-46, 28 refs. (April 11-13.)*

Changes in the bryophyte flora of Britain may be either apparent (due to increased survey work or changing taxonomies) or real (due to increases, decreases, or introductions of species). While some native species have undoubtedly increased over the last century, it is certainly among introduced species that the most spectacular increases have occurred. Most real changes which have taken place have been decreases correlated with deforestation, drainage, anr and water pollution, and changes in agricultural practices. Some mire species have totally disappeared, and some formerly widespread epiphytes have now become very rare and more restricted in their distribution. Many declines appear to be due largely to widespread air pollution, but felling of old trees and changes in forestry practice have also played a major part. Pollution by sulfur dioxide has mainly caused reductions in the frequency and abundance of epiphytic bryophytes. All epiphytic brophytes except the most tolerant have been eliminated over a wide area of England from the London area, southern East Anglia, and the Lower Thames Valley up through the Midlands to Lancaster in the northwest and Tyneside in the northeast, and also in industrial South Wales and central Scotland. Sulfur dioxide has caused declines in most fertility and lichen distribition. It is clear that many bryophytes will continue to become rarer in the future and that some further species will become extinct in Britain. (Author abstract modified)

1972

49354 **APTIC NO. 70487**

Gordon, C. C.

MOUNT STORM STUDY. *Montana Univ., Environmental Studies Lab., Environmental Protection Agency Contract 68-02-0229, 32p., Nov. 17, 1972.*

A 3-year study of coniferous foliage damaged by phytotoxic elements, compounds, and particulate matter in the Mt. Storm area of West Virginia and Maryland revealed that the major causal agents are waste products from coal-burning utility plants. The primary pollutant causing damage is sulfur dioxide and its by-product sulfuric acid. The SO_2 in the ambient air of the study area causes most of the needle tip necrosis, then progresses to total needle necrosis, and eventually causes premature needle casting. The H_2SO_4 causes the short-long needle syndrome and much of the reduction in terminal shoot elongation of several coniferous species grown for Christmas tree production. This acid is also responsible for premature needle casting of short needles when basal necrosis becomes severe enough to affect the vascular tissues. Fly ash particulates in the Mt. Storm area contain high concentrations of several elements and compounds, some of which are known to be phytotoxic, such as fluorides and sulfates. Iron, aluminum, and other compounds may or may not affect the trees. Gaseous and particulate fluorides in the area are from the burning of coal. Greenhouse and field studies of white, Scotch, and ponderosa pine seedlings demonstrated that fly ash slurries and hydrofluoric acid will cause two growth abnormalities -- excessive lateral bud production and excessive terminal stem growth. Innoculation of young emerging conifer needles with HF caused the short-long syndrome. Samples collected in six polluted areas in the northwestern U. S. gave further evidence that HF and H2SO4 could cause growth abnormalities. Histological and chemical studies showed the disease syndromes occurring in the Mt. Storm area were identical to those occurring in the northwestern states. It will be impossible to cultivate the three species of conifers under healthy conditions in the Mt. Storm area until adequate abatement equipment is installed at large stationary emission sources of SO2, fluoride, and particulates in the area. (Author summary modified)

49355 **APTIC NO. 71202**

Schoenbeck, H.

INVESTIGATIONS IN NORTH RHINE-WESTPHALIA ON LICHENS AS INDICATORS OF AIR POLLUTANTS. *(Untersuchungen in Nordrhein-Westfalen ueber Flechten als Indikatoren fuer Luftverunreinigungen). Schriftenreihe Landesanstalt Immissions- und Bodennutzungsschutz Landes Nordrhein-Westfalen (Essen), vol. 26:99-104, 1972. 31 refs. Translated from German. Translation Consultants, Ltd., Arlington, Va., 16p. (TR 391-73)*

Extensive area investigations were conducted on the distribution of naturally-growing lichens and on the behavior of test lichens in industrial and nonindustrial sections of the North Rhine- Westphalia area. Lecanora coniceoides lichens were frequently found in zones on the edge of the Ruhr Area where few species grow, indicating the action of sulfur dioxide pollutants. Lichens exposed in the vicinity of a hydrochloric acid emitter showed decay effects correlated with distance from the pollution source. Test lichens in areas with little or no lichen growth clearly showed damage, whereas such lichens did not exhibit damage in areas where lichen species were abundant. Degree of lichen damage was positively correlated with SO2 levels monitored in the test areas. Lichens are thus a suitable indicator for the recognition of air pollutants and for the monitoring and delineation of pollution sources.

1971

49356 **APTIC NO. 71193**

Ingold

THE ADVANCE OF MYCOLOGY. *Trans. Brs. Mycol. Soc., 58(2):5-16, 1972. (Also: Exeter Univ. (England), Proc. Int. Mycolog. Congr., 1st, 1971, p. 5-16. (Sept. 8-15.))*

The study of fungi is discussed. Advances in knowledge about fungi are reviewed. The dispersion of fungi spores is also mentioned. The use of lichens as a biological indicator of pollution is also discussed. Lichens are extremely sensitive to sulfur dioxide in the air. Therefore, tree trunks close to large industrial centers are free from lichens; farther out, the resistant Lecanora conizaeoides encrusts the trunks to the exclusion of other types of lichens; and many miles farther into the country, normal tree-trunk flora take over.

EFFECTS-MATERIALS

1975

49357 **APTIC NO. 70380**

Ergang, R. and M. . Rockel

CORROSION RESISTANCE OF STAINLESS STEELS AT THE ATMOSPHERE - EVALUATION OF THE RESULTS OF WEATHERING TESTS UP TO 10 YEARS DURATION. *(Die Korrosionsbestaendigkeit der nichtrostenden Stachle an der Atmosphaere - Auswertung von Versuchen bis zu 10 jaehriger Auslagerung). Text in German. Werkstoffe Korrosion, 26(1):36-41, 1975. 8 refs.*

The evaluation of results obtained in the course of weathering tests of up to 10 yr duration has confirmed the conclusions drawn after 1 yr of exposure. A chromium-nickel-molybdenum steel (Werkstoff No. 1.4401) can be used even in the most severe conditions; slight corrosions found in marine atmospheres can be attributed to unpolished surfaces. The 17% chromium steel is considerably attacked in industrial and marine atmospheres and should not be used for the external parts of buildings. The 18/8 steels are perfectly resistant to urban atmospheres, with the exception of those portions which are not exposed to the cleansing effect of rain waters. In all the cases studied the corrosion resistance of the steels has been improved by electropolishing. Electrochemical studies have further revealed that the pitting corrosion susceptibility decreases in the same order as the atmospheric corrosion resistance.

1974

49358 **APTIC NO. 71091**

Ishido, S., Y. Nakane, Y. Ota, and T. Miyazaki

EFFECT OF SO2 ON STEEL CORROSION. *(SO2 no kohan fushoku ni oyobosu eikyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution). 9(2):392, Nov. 1974. 1 ref. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 247.)*

The effects of sulfur dioxide, temperature, and humidity on steel corrosion are studied. Three steel pieces and three alkaline filter papers to measure SO2 amounts are placed in a chamber and exposed to SO2 gas for 7 days. Temperature and humidity are also adjusted. Higher values in temperature, humidity, and SO2 level all increased steel corrosion; however, temperature had the least effect. More corrosion was observed with high humidity and high SO2 levels. The corrosion in mg/sq dm/day was 70 and 15 for SO2 in concentrations of 0.70 ppm and 0.10 ppm, respectively, and at 100% humidity. At an SO2 level of 0.3 ppm, the corrosion was 12 and 40 mg/sq dm/day for humidities of 77% and 100% respectively. If humidity is above 90%, the steel corrosion will occur at the normal atmospheric SO2 level which is generally below 0.06 ppm.

EFFECTS-ECONOMIC

1975

49359 **APTIC NO. 70332**

Usui, Hisashi

PRESENT STATUS AND TREND IN POLLUTION CONTROLLING INDUSTRIES. *(Kogai boshi sangyo no genjo to doko). Text in Japanese. Puranto Enjinia (Plant Eng.), 7(1):26-30, Jan. 1975.*

The term pollution control industry refers to industries engaged in the production of pollution control devices. The general status and trends in production systems, technical development, and distribution systems are discussed. The total number of companies producing pollution control devices exceeds 1000, and the resulting excessive competition and makers of poor products indicates the need for a consensus system within the industry. The most urgent task in the field of technical development is the development of suitable materials such as metallic material with high corrosion resistance and thermal stability which can withstand severe conditions under which the pollution control devices are used. In the distribution system, the emphasis is placed on the establishment of proper procedures for service and maintenance. The market trend is analyzed and discussed in terms of gross production, ratio by types of control devices, yearly growth rate in gross production, and yearly investment in the pollution control device industry. The ratio of product exported is extremely small, though it is increasing yearly. This is probably the reflection of the urgent demand in the domestic market.

1974

49360 **APTIC NO. 70476**

Cohen, Alan S. and Arthur P. Hurter, Jr.

AN INPUT-OUTPUT ANALYSIS OF THE COSTS OF AIR POLLUTION CONTROL. *Manage. Sci., 21(4):453-461, Dec. 1974. 4 refs.*

Pollution control costs are considered in three categories: costs of control equipment, costs of switching to cleaner fuels or processes, and costs to consumers measured by changes in a consumer price index. The sum of the first two are direct costs, while the third is an indirect cost. An input- output model is developed which permits inclusion of both direct and indirect costs in the measure of pollution control costs. When there is at least one firm in the community described by the model required to control its pollution, the prices of all consumer goods will be higher after the imposition of controls than before; the increase in price will be at least as great as the direct costs of pollution control in the production of each good. If each industry can independently minimize its direct cost of pollution control, then the indirect costs will also be minimized. When shortages of clean fuels are considered, firms and industries cannot all control their emissions optimally. In this case, overall minimization of the direct costs of control will not generally result in minimization of the indirect costs as well. However, a particular kind of weighting of industry by industry-direct control costs is developed, such that minimization of this weighted sum results in minimization of indirect costs as well. (Author abstract modified)

49361 **APTIC NO. 71220**

Kapp, K. William (ed.)

ENVIRONMENTAL DISRUPTION AND SOCIAL COSTS: CHALLENGE TO ECONOMICS. *In: Environmental Policies and Development Planning in Contemporary China and Other Essays. K. William Kapp (ed.), Paris, Mouton, 1974, Chapt. 3, p. 77-88. 17 refs.*

The adequacy of traditional economic analysis in dealing with environmental disruption and its resulting social costs is questioned. The important problems of economic analysis, when understood as a political science of public affairs, are cited as involving extra-market and extra-industry cause and effect relations as opposed to intra-firm and intra-industry relations. Environmental disruption and social costs are considered as the outcome of an interaction of several complex systems (economic, physical, meteorological, biological) in which several factors interplay through feedback processes not explored by current economic analysis. A policy of economic growth guided by inadequate and incomplete indicators of output and income is projected to result in a pseudogrowth in which increases of consumption or investment are made possible not by the growth of net production but at the expense of diminishing natural resources (air, water, land).

49362 **APTIC NO. 70620**

Lalor, William G., Jr.

CLEAN AIR. *EEI Bull., 42(5):227-232, Sept./Oct. 1974.*

The costs of complying with the Clean Air Act of 1970 for electric utility companies are discussed, and alternatives are proposed. The national cost for controlling sulfur oxides in compliance with the Clean Air Act would be $10 billion/yr. Costs for individual companies would go up by 1/3, while the consumer s cost would increase by 75%. There is no clear relationship between people s health and sulfur oxide levels at ambient air quality limits or at twice those limits. House of Representative bill 13454 was introduced to amend the Clean Air Act so that alternative nonuniform means could be used to meet ambient air quality standards. The bill would: define the words protect and enhance; encourage air quality control measures that consider total environmental, economic, and social impacts; allow alternates to uniform emission limitations; and provide for revision of state plans if more cost-effective methods of meeting air quality standard s become available. A procedure is provided by which the operator of a stationary source could apply for a particular emission limit for an individual plant. The plant operator would have to show that he would meet and maintain ambient air quality standards.

49363 **APTIC NO. 71481**

Mueller, K.

TECHNOLOGY AND ENVIRONMENTAL PROTECTION. ENVIRONMENTAL PROTECTION AND ORGANIZATION OF THE PRODUCTION PROCESSES OF POLITICAL ECONOMY. *(Technik und Umweltschutz. Umweltschutz und Gestaltung des volkswirtschaftlichen Reproduktionsprozesses). Text in German. Technik (Berlin), 29(11):714-716, Nov. 1974. 14 refs.*

For economic planning it is important to determine the rank environmental protection deserves within the scope of public needs. Measures for conservation of the natural environment lead to new proportions in production and consumption. The benefit of measures for environmental protection can be estimated by calculating the costs which would be required for repairing damages of material and human health. Possible measures to protect and improve the environment include legal standards, and creation of conditions which stimulate investments for cleaning facilities in industries and enterprises. While in scientific and technical respects all problems have been solved, economic difficulties are encountered because of considerable expenditures. The introduction of fees for polluting activities is recommended. Such fees would be effective if they are higher than the costs for pollution reducing equipment.

49364 **APTIC NO. 70822**

Schwartzwalder, Karl and Dana W. Stewart

THE IMPACT OF EMISSION CONTROL SYSTEMS ON MATERIAL RESOURCES. *Preprint, Society of Automotive Engineers, New York, 11p., 1974. 15 refs. (Presented at the Society of Automotive Engineers Automotive Engineering Congress, Detroit, Mich., Feb. 25-March 1, 1974, Paper 740195.)*

The impact of catalytic converter emission control systems for automobiles is considered in terms of material consumption and the need for recycling such materials. An estimated 1,410,000 oz of platinum will be needed for 1975 model cars, though later this amount could drop to less than 1,000,000 oz/yr. The quantity of this metal needed is projected to double or even triple the annual consumption at present, costing an estimated $200 million annually. The manufacture of emission control systems is expected to add greatly to the imbalance of foreign trade in mineral commodities. Greater reclamation of automobiles and the production of lighter-weight cars are suggested as means for conserving such materials.

49365 **APTIC NO. 71376**

Suzuki, Minoru

SURVEY IN CAPITAL INVESTMENT FOR POLLUTION CONTROL 1974. *(Kotoshi no kogai boshi no chosa gaiyo). Text in Japanese. Kagaku Kojo (Chem. Factory), 18(12):64, Dec. 1974*

A survey was conducted by banks and government agencies on capital investment for pollution control in 1974. The survey conducted by the Japan Development Bank showed that in 1973, $180 million were spent by 1219 companies with assets of more than $3.3 million each. The increase in 1974 was nearly 100%, with a total spending of $353 million. In 1973, 333 companies under the supervision of the Ministry of Agriculture and Forestry invested $5.4 million for pollution control, an increase of 160% from the previous year, and the spending in 1974 was $79 million.

1973

49366 **APTIC NO. 70399**

Barrett, Larry B. and Thomas E. Waddell

COST OF AIR POLLUTION DAMAGE: A STATUS REPORT. *Environmental Protection Agency, Research Triangle Park, N. C., National Environmental Research Center, Rept. AP-85, 81p., Feb. 1973. 72 refs.*

GPO

Published and unpublished estimates of the cost of air pollution damage are reviewed and national total estimates are given. The total national cost in 1968 resulting from air pollution was $16.1 billion, which included $5.2 billion for residential property, $4.7 billion for materials, $6.1 billion for health, and $0.1 billion for vegetation. The cost for each effect was distributed among the several pollutants considered responsible for that effect according to their relative emissions, and the same cost was distributed among the sources by their relative emissions. No cost function relations were found for various levels of pollution, and consequently the pivotal functions of marginal benefit were precluded. (Author abstract modified)

49367 **APTIC NO. 70865**

Gamble, Hays B., C. John Langley, Jr., Robert D. Pashek, Owen H. Sauerlender, Richard D. Twark, and Roger H. Downing

COMMUNITY EFFECTS OF HIGHWAYS REFLECTED BY PROPERTY VALUES (FINAL REPORT). *Pennsylvania State Univ., University Park, Inst. for Research on Land and Water Resources, Dept. of Transportation Contract DOT-FH-11-7800, 336p., Aug. 1973. 77 refs.*

The effects of highway generated noise, air pollution, and regional accessibility on single-family residential property values were investigated for four residential communities abutting interstate highways in Maryland, New Jersey, and Virginia. Numerous household characteristics, traffic data, and measures for noise, carbon monoxide, nitrogen oxides, hydrocarbons, and particulates were utilized. Residents were also interviewed to record their perceptions of environmental disturbances. Highway disturbances in general annoyed 58% of the abutters and 12% of the nonabutters in all four areas. Carbon monoxide isopleths for three of the study areas revealed that the maximum federal standard of 9 ppm over an 8-hour average was not exceeded under average weather and traffic conditions. Air pollutants by themselves appeared to have no significant effect on property values. There was, however, a great amount of intercorrelation between the highway effects variables, making it impossible to estimate the portion of the total effects attributable to any of the variables separately. Total benefits to 1694 properties in one community where accessibility indices were available to over $5,000,000 while losses amounted to $303,000.

1972

49368 **APTIC NO. 71200**

Hirsch, Werner Z., Sidney Sonenblum, and Jerry St. Dennis

APPLICATION OF INPUT-OUTPUT TECHNIQUES TO QUALITY OF URBAN LIFE INDICATORS. *California Univ., Los Angeles, Inst. of Government and Public Affairs, Reprint 78, p. 511-533, 1972. 21 refs.*

The application of input-output techniques to the quality of urban life is discussed in terms of indicators for monitoring key components of various urban systems. The total urban environment is divided into five environmental systems: natural (air, water, and land use), spatial, economic, public service, and socio-cultural. Air pollution is an example of an indicator which is directly influenced by the levels of specific sector activities. Linkage coefficients, e.g., pollution coefficients, establish the relationship between sector outputs and the quality of life indicators. The total amount of any particular pollutant discharged into the air can be determined by multiplying the estimated levels of output of various individual interindustry sectors by the appropriate coefficients for a particular type of pollution, with the resulting outputs of pollutants being summed. The total outputs of various pollutants can then be used as indicators of air quality. This technique can in principle be applied to a number of indicators for various environmental systems. However, many natural environmental subsystems, especially pollution, involve major externalities which are nonmarket transactions without price and quantity signals. Thus, reliable data for the estimation of natural environment coefficients cannot be expected.

STANDARDS AND CRITERIA

1975

49369 **APTIC NO. 70753**

Quarles, John

LOW-EMISSION VEHICLE CERTIFICATION BOARD. DETERMINATION REGARDING SUITABILITY OF PURCHASE BY FEDERAL GOVERNMENT. *Federal Register, 40(26):5562, Feb. 6, 1975.*

The Low Emission Vehicle Certification Board determined that six battery-powered vehicles qualifying as low-emission vehicles under section 212(c) of the Clean Air Act were not suitable substitutes for any vehicles presently being purchased by the Federal government in accordance with criteria specified in section 212(d) of the Clean Air Act. The vehicles were rejected as substitutes for existing vehicles covered by the General Services Administration procurement specifications since they did not meet performance requirements in terms of acceleration, high- speed passing, maximum sustained velocity, and maximum range. The vehicles were submitted for certification under section 212 of the Clean Air Act by the Battronic Truck Corporation Division of the Boyertown Auto Body Works.

49370 **APTIC NO. 71422**

Quarles, John

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES. COAL REFUSE. *Federal Register, 40(11):2803, Jan. 16, 1975.*

An amendment to Part 60--Standards of Performance for New Stationary Sources is proposed to clarify the applicability of 60.44 with regard to units burning significant amounts of coal refuse. While nitrogen oxides emissions from coal refuse-fired cyclone boilers are expected to be up to three times the standard of performance, the predicted maximum ground-level concentration increase for the only currently planned coal-refuse-fired unit (173 MW) is 2 micrograms NOx/cu m. This predicted increase would raise the total ground-level concentration around this source to only 5 micrograms NOx/cu m, which is well below the national ambient standard. Section 60.44 is amended to exempt steam generating units burning at least 25% (by wt) coal refuse from the NOx standard of performance. Such units must comply with the sulfur dioxide and particulate matter standards of performance.

1974

49371 **APTIC NO. 70337**

aum, Fritz

MEASURES FOR THE REDUCTION OF EMISSIONS FROM WOOD-FIRED FURNACES. *(Massnahmen zur Verminderung der Emissionen von Holzfeuerungen). Text in German. Gesundh.-Ingr., 95(12):362- 363, 1974.*

In its first ordinance concerning execution of the Federal Immission Protection Act, the Federal Republic of Germany limited the emissions from small and large firing systems for solid fuels. Small firing systems up to 80,000 kilojoule/hr (19,000 kcal/hr) must be fired with dry wood to reduce smoke emission. For large firing systems above 80,000 kilojoule/hr, limit concentrations for dust, soot, and tar refer to a carbon dioxide concentration of 12 vol % in the waste gas. For manually charged firing systems the limits are 150 mg/cu m and for mechanically charged systems they are 300 mg/cu m.

49372 **APTIC NO. 71498**

Tuerk, Edward F.

METROPOLITAN PHILADELPHIA REGION. PROPOSED PLAN DEMONSTRATING ATTAINMENT AND MAINTENANCE OF THE NATIONAL SECONDARY SULFUR DIOXIDE (SO2) STANDARD: PUBLIC HEARING. *Federal Register, 39(237):42943, Dec. 9, 1974.*

A public hearing on the proposed plan for the metropolitan Philadelphia region demonstrating attainment and maintenance of the national secondary sulfur dioxide standard is announced. On Aug. 8, 1974 the Environmental Protection Agency proposed a plan for the attainment of the national standard for SO2 as required by section 110 of the Clean Air Act. The proposal consisted of approving the existing implementation plan for the area as adequate to obtain the secondary SO2 standard by July 1975. The proposal was based on a review of air quality data from the existing air quality monitoring network in the Pennsylvania portion of the Metropolitan Philadelphia Region. Data for 1973 show a complete absence of violations of the secondary (3-hour) standard.

49373 **APTIC NO. 71246**

American Society for Testing and Materials, Philadelphia, Pa.

TENTATIVE RECOMMENDED PRACTICE FOR GENERAL AMBIENT AIR ANALYZER PROCEDURES. *Book ASTM Stand., no. 26:708-714, 1974. 9 refs.*

A general procedure for ambient air analyzer practices is outlined. The procedure involves the following steps: installation in accordance with information supplied by the manufacturer, precalibration with samples representative of the atmosphere to be analyzed, a check of all operating parameters in accordance with the application engineering data and the method for specific analysis once atmospheric sampling has begun, sample analysis observation after the analyzer is thoroughly purged with the sample, validation of analyzer results if desired, and periodic calibration checks with either spot sample for standard sample techniques. Calibration or validation data, analytical data over the sampling period, and information on the method s precision are included in a report of the analyzer system.

1973

49374 **APTIC NO. 70838**

Ramchandar, C. K.

STACK EMISSION STANDARDS - RANDOM THOUGHTS. *Central Labour Inst., Bombay (India), Proc. Semin. Air Pollut. Control Tech., India, 1973, p. 90-95. (Sept. 11-12.)*

The difficulty in establishing rigid emission standards for industries in India based on scientifically evolved air quality criteria is discussed in relation to financial and technical limitations. As an alternative, the best possible means approach is suggested, involving pragmatic emission standards based on the type of process, the density of operations in a given industrial location, and the nature of materials handled. Standards formulated by advanced countries can not be simply adopted since additional stresses like poor nutritional status or exposure to hot climate which are prevalent in India increase the toxic effects of substances. Indian workers exposed to workroom concentrations of sulfur dioxide as low as 2.25 mg/cu m showed lowered pulmonary functions despite the fact that the threshold limit value for SO2 is 13 mg/cu m.

49375 **APTIC NO. 70427**

National Environment Protection Board, Solna (Sweden), Air Council

GUIDELINES FOR AIR POLLUTION CONTROL AT STATIONARY SOURCES IN SWEDEN. EMISSION LIMITS, DIRECTIONS FOR THE MEASUREMENT OF EMISSIONS AND DETERMINATION OF CHIMNEY HEIGHT. *Rept. SNV PM 381E, 50p., Nov. 1973. 7 refs.*

Existing guidelines for air pollution control at stationary sources in Sweden were revised based on field investigations which examined the current emissions and on the technical and economic possibilities available to reduce such emissions. Decisive in determining the extent of the air pollution control measures has been an assessment of what is technologically achievable within a realistic economic framework (best practicable means). Recommended guidelines are given for both new and existing establishments for the following types of plant: iron and steelworks, sintering plants, blast furnaces, open-hearth furnaces, converter processes, electric arc furnaces, cupolas, manufacture and handling of lime, oxygen cutting, ferro-alloy plants, semi-closed furnaces for manufacturing ferrosilicon, furnaces for manufacturing metallic silicon and ferrosilicon chromium, furnaces and ladles for manufacturing refined ferrochromium, furnaces for manufacturing ferrosilicon manganese, furnaces for manufacturing ferromolybdenum, foundries, remelting works for noniron metals, surface treatment, cement plants, stone crushing plants, hot-mix asphalt paving plants, petroleum refineries, storage facilities for petroleum products, sulfuric acid plants, chlor-alkali plants, sulfate cellulose plants, sulfite cellulose plants, heavy-oil fired steam generators, gas turbine power plants, solid waste incinerators, wood and bark heated plants, and plants for burning scrapped cables. The determination of chimney height for sulfur dioxide emission and general directions concerning measurement of air pollutant emissions and evaluation of measurement results are discussed in appendices.

49376 **APTIC NO. 70429**

Committee on Air Quality Criteria for Oxides of Nitrogen and Photochemical Oxidants (Japan)

REPORT OF THE EXPERT COMMITTEE ON AIR QUALITY FOR OXIDES OF NITROGEN AND PHOTOCHEMICAL OXIDANTS. *In: Compliance With Title II (Auto Emission Standards) Of The Clean Air Act. 93rd Congress (U. S. Senate), First Session, Serial 93-H23, p. 404-409, Nov. 5 and 6, 1973. (Hearings Before the Committee On Public Works.)*

GPO

Recommendations for year-round ambient concentrations of nitrogen dioxide and photochemical oxidants (including ozone) are presented on the basis of a review of their toxicity to humans and presently available measuring techniques. A mean concentration value for consecutive 24 1-hour measurements of below 0.02 ppm is recommended for nitrogen dioxide which is highly toxic (especially in terms of long-range effects) and potentiated in its effects by the presence of sulfur dioxide. A 1-hour mean concentration value of below 0.06 ppm is recommended for photochemical oxidants which are capable at concentrations of 0.5-1.0 ppm (1-2 hr) of increasing airway resistance, lowering carbon monoxide diffusion in the lungs, and decreasing vital capacity. Both nitrogen dioxide and photochemical oxidants are irritants to the respiratory system. The reference method adopted for nitrogen oxides is the Saltzman colorimetric method and that for photochemical oxidants a potassium iodide colorimetric method.

LEGAL AND ADMINISTRATIVE

1975

49377 **APTIC NO. 70383**

Guck, Rudolf

REGULATIONS CONCERNING ENVIRONMENTAL PROTECTION AND SITE SELECTION FOR NUCLEAR POWER PLANTS. *(Umweltschutzbestimmungen und Standortwahl fuer Kernkraftwerke). Text in German. Elektrotech. Z. A, 96(1):38-44, 1975. 9 refs.*

Criteria for the selection of a suitable site for a nuclear power plant are given. Limits are imposed by the need of cooling water. The worsening thermal pollution of rivers made the construction of cooling towers necessary. Two problems arose as a consequence of the construction of cooling towers, changes of the micro-climate in the vicinity of the cooling tower and the need to replenish the water losses by evaporation. Extensive investigation of the effects of cooling towers on the environment showed that no drastic impact on meteorology and climate is to be expected but specific meteorological and climatic measurements near each individual cooling tower are an absolute must.

49378 **APTIC NO. 70493**

Hamanaka, H.

A TOTAL QUANTITY CONTROL PROGRAM FOR AIR POLLUTION AND ITS PROLEMS. *(Taikiosen no soryokisei to sono mondaiten). Text in Japanese. Kankyuo Gijutsu (Environ. Conserv. Eng.), 4(1):20-28, Jan. 1975.*

A total control program for sulfur oxides in air pollution is discussed. The survey methods, including local conditions, total emissions, air quality criteria, and fuel standards are discussed. Controversy over enforcement of total quantity control is outlined. The history and legislation of air pollution control in Japan is explained. Calculation of total emissions is demonstrated, based on legal requirements and present control and measurement technology.

49379 **APTIC NO. 70494**

Hashimoto, M.

THE DIRECTION OF FUTURE ENVIRONMENTAL CONTROL. *(Kongono kankyo kanri no hoko). Text in Japanese. Kankyo Gijutsu (Environ. Conserv. Eng.), 4(1):2-6, Jan. 1975.*

Problems of environmental control are discussed from the viewpoints of the social sciences, natural sciences, and technology. Legislation, demography, economics, and natural resources are discussed in relation to the development of pollution control methods. Enforcement of legislation concerning control technology is the major control strategy at present. An environmental assessment, assessments of chemical compounds, chronic and acute pollution effects, and an integrated policy approach are given.

49380 **APTIC NO. 70793**

Meyers, Sheldon

ENVIRONMENTAL IMPACT STATEMENTS AND OTHER ACTIONS IMPACTING THE ENVIRONMENT. AVAILAILITY OF COMMENTS. *Federal Register, 40(20):4335-4340, Jan. 29, 1975.*

Appendices containing Federal Agency actions impacting the environment which have been reviewed and commented upon in writing by the Environmental Protection Agency during the period December 1, 1974 to December 31, 1974 are listed. Appendix I contains a listing of draft environmental impact statements reviewed and commented upon in writing and includes the Federal agency responsible for the statement, the classification of the nature of EPA s comments, and the EPA source for copies of comments. Appendix II contains definitions of EPA s comments on the draft environmental impact statement. Appendix III contains a listing of final environmental impact statements reviewed and commented upon in writing. Appendix IV contains a listing of proposed Federal agency regulations and actions reviewed and commented upon in writing. Appendix V contains a listing of the names and addresses of sources for copies of EPA comments. Copies of the draft and final environmental impact statements are available from the originating Federal department or agency.

49381 **APTIC NO. 70784**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. IOWA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(20):4272- 4273, Jan. 29, 1975.*

The approval of revised compliance schedules for Iowa is announced. Each revision establishes a new date by which the source must comply with the applicable emission standard in the federally approved state implementation plans.

49382 **APTIC NO. 70785**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. IOWA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(20):4270- 4272, Jan. 29, 1975.*

The approval of revised compliance schedules for the state of Iowa is announced. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State Implementation Plan. Under Iowa law, the compliance schedule is not enforceable after the date on which the associated variance expires and variances cannot extend for more than 1 yr. To the extent that the Iowa schedules extend past the variance expiration date, they are not legally enforceable at this time. The Environmental Protection Agency s approval of each compliance schedule is unconditional only as to that part of the schedule covered by the initial variance. Approval of the remainder of the schedule will be conditioned upon the State s renewal of the variance in identical form and substance to that included in the schedule submitted to the EPA and approved.

49383 **APTIC NO. 70786**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. CALIFORNIA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(20):4267-4268, Jan. 29, 1975.*

The approval of revised compliance schedules for the state of California is announced. Each approved revision establishes a new date by which the individual air pollution source must comply with the applicable air quality control regulations. Some schedules include incremental steps towards compliance with the specified regulations. The increments of progress, as well as the final compliance date, are legally enforceable by the Administrator of the Environmental Protection Agency pursuant to Section 113 of the Clean Air Act, as amended. The schedules meet the requirements of Sections 51.6 and 51.15. All regulations cited are air pollution control regulations of the air pollution control district where the source is located. Section 52.240 is amended by the addition of the schedules.

49384 **APTIC NO. 70787**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. SOUTH CAROLINA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 49(16):3568-3569, Jan. 23, 1975.*

The approval of compliance schedules for South Carolina is announced. Each schedule establishes a date by which an individual air pollution source must attain compliance with the emission limitations of the State implementation plan. Many schedules include incremental steps toward compliance with specific dates set for achieving those steps. All schedules satisfy the requirements of 40 CFR Part 51 pertaining to plan revisions and compliance schedules. Approval will not hinder the attainment and maintenance of the national ambient air quality standards.

49385 **APTIC NO. 70788**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. MISSOURI: APPROVAL AND DISAPPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(16):3566-3568, Jan. 23, 1975.*

The approval and disapproval of revised compliance schedules for Missouri are announced. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State Implementation Plan. All schedules include incremental steps toward compliance with the applicable emission limitations.

49386 **APTIC NO. 70789**

Quarles, John

APPROVAL AND PROMULGATION OF STATE IMPLEMENTATION PLANS. WEST VIRGINIA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(16):3569-3570, Jan. 23, 1975.*

The approval of compliance schedules for West Virginia are announced. Each revision and schedule establishes a date by which an individual air pollution source must attain compliance with an emission limitation specified by the State Implementation Plan. Most schedules include incremental steps towards compliance with interim dates for achieving those steps. Each revision and compliance schedule listed was adopted by the West Virginia Air Pollution Control commission and submitted to the Environmental Protection Agency after notice and public hearings in accordance with the procedural requirements of 40 CFR Part 51.

49387 **APTIC NO. 71004**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. KANSAS: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(20):4268-4269, Jan. 29, 1975.*

The approval and promulgation of revised compliance schedules for the state of Kansas are announced. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved state implementation plan. All schedules include incremental steps toward with the applicable emission limitations.

49388 **APTIC NO. 71019**

Quarles, John

APPROVAL AND PROMULGATION OF STATE IMPLEMENTATION PLANS. NEVADA SO2 CONTROL STRATEGY. *Federal Register, 40(26):5508-5523, Feb. 6, 1975.*

Background information, public comments, findings from Environmental Protection Agency monitoring activities, and a description of promulgated regulations are provided in a rulemaking by the EPA Administrator concerning the Nevada state implementation plan. The rulemaking covers the following actions: approval of the visible emissions article of the Nevada Air Quality Regulations, disapproval of the implementaion plan for attainment and maintenance of primary sulfur dioxide standards in the Nevada Intrastate Air Quality Control Region, the promulgation of substitute regulations for the control of SO2 at the Kennecott Copper Corporation Smelter, and the promulgation of an extension of time to meet the primary standards.

49389 **APTIC NO. 71407**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. MISSISSIPPI: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(15): 3430-3441, Jan. 22, 1975.*

The approval of compliance schedules for the state of Mississippi is announced. Each schedule establishes a date by which an individual air pollution source must attain compliance with the emission limitations of the State implementation plan. Many schedules include incremental steps toward compliance, with specific dates set for achieving those steps. All schedules satisfy the requirements of 40 CFR Part 51 pertaining to plan revisions and compliance schedules. Approval will not hinder the attainment and maintenance of the national ambient air quality standards.

49390 **APTIC NO. 71409**

Quarles, John

CONNECTICUT. CONTROL OF AIR POLLUTION FROM FACILITIES OWNED, OPERATED OR UNDER CONTRACT WITH CONNECTICUT TRANSPORTATION AUTHORITY. *Federal Register, 40(11):2832-2833, Jan. 16, 1975.*

A regulation to control the air pollution from facilities owned, operated, or under contract with Connecticut Transportation Authority is proposed. Under the present state of the law in Connecticut, the State does not have the legal authority required by the Clean Air Act and Environmental Protection Agency regulations to control a group of facilities controlled by the State in accordance with the State's Implementation Plan. Regulations are proposed that are applicable to all Connecticut Transportation Authority facilities and which are identical to Connecticut Regulations for the Abatement of Air Pollution Sections 19-508-1 through 19-508-25 inclusive. Copies of the regulations are available for public inspection and public comment is invited.

49391 **APTIC NO. 71410**

Quarles, John

CALIFORNIA. PROPOSED DISAPPROVAL BY SULFUR DIOXIDE REGULATION. *Federal Register, 40(21):445-447, Jan. 30, 1975.*

A replacement regulation for the control of sulfur dioxide in the San Francisco Bay Area Intrastate Region is proposed.

Sections 3121-3123.9, 4110, 5110, and 6110 of Regulation 2 of the Bay Area Air Pollution Control District are disapproved as not meeting the requirements of section 110(a)(2)(B) of the Clean Air Act as amended. The proposed replacement regulation would not allow the emission of gas containing SO2 in excess of 300 ppm (vol). All sampling of exhaust gases would follow the prescribed techniques. All sulfur present in gaseous compounds containing oxygen shall be deemed to be present as SO2, and analysis of samples taken to determine the amount of SO2 in exhaust gases shall be made according to specified regulations. No person shall cause, let, permit, suffer, or allow the emission from any incineration operation, salvage operation, heat transfer operation, or any general combustion operation of SO2 in excess of 300 ppm (vol).

49392 **APTIC NO. 71420**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. NORTH CAROLINA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(15):3441-3444, Jan. 22, 1975.*

The approval of compliance schedules for North Carolina is announced. Each establishes a date by which an individual air pollution source must attain compliance with the emission limitations of the State Implementation Plan. Many schedules include incremental steps toward compliance with specific dates set for achieving those steps. All schedules satisfy the requirement of 40 CFR Part 51 pertaining to compliance schedules and plan revisions. Their approval will not hinder the attainment and maintenance of the national ambient air quality standards.

49393 **APTIC NO. 71421**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. MISSOURI: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(20): 4269-4270, Jan. 29, 1975.*

The approval of revised compliance schedules for the state of Missouri is announced. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State Implementation Plan. All schedules include incremental steps toward compliance with the applicable emission limitations.

49394 **APTIC NO. 71423**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. APPROVAL OF IDAHO INDIRECT SOURCE REGULATION. *Federal Register, 40(21): 4420-4421, Jan. 30, 1975.*

The approval of the indirect source regulation for Idaho is announced. The amendments to Idaho s rules and regulations provide for preconstruction review of indirect sources both in an outside of urbanized areas. An urbanized area is defined as any area within the city limits, or within 5 mi of the city limits, or any city with a population of more than 10,000 persons. The sources include: new parking facilities in urban areas for 1000 cars or for 2000 cars in non-urban areas; modified parking facilities for 500 cars in urban areas or for 1000 cars in non-urban areas; any new highway section with an anticipated annual average daily traffic volume of 20,000 or more vehicles/day; any modified highway section which will increase annual average traffic volume by 10,000 vehicles/day; and any new airport or airport modification with 50,000 or more operations/yr or which will be used by 1,600,000 passengers/yr.

49395 **APTIC NO. 71424**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. KENTUCKY: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(15): 3417-3430, Jan. 22, 1975.*

The approval of compliance schedules for Kentucky is announced. Each schedule establishes a date by which an individual air pollution source must attain compliance with the emission limitations of the State implementation plan. Many schedules include incremental steps toward compliance with specific dates set for achieving those steps. All schedules satisfy the requirements of 40 CFR Part 51 pertaining to plan revisions and compliance schedules. Approval does not hinder the attainment and maintenance of the national ambient air quality standards.

49396 **APTIC NO. 71425**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. GEORGIA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(15): 3413-3417, Jan. 22, 1975.*

The approval of compliance schedules for Georgia is announced. Each schedule establishes a date by which an individual air pollution source must attain compliance with the emission limitations of the State implementation plan. Many schedules include incremental steps toward compliance with specific dates set for achieving those steps. All schedules satisfy the requirements of 40 CFR Part 51 pertaining to plan revisions and compliance schedules. Approval will not hinder the attainment and maintenance of the national ambient air quality standards.

49397 **APTIC NO. 71408**

Wright, Charles V.

MISSOURI. APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 40(6):1711-1712, Part 1, Jan. 9, 1975.*

The approval of revised compliance schedules for the state of Missouri is announced. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the Federally approved State Implementation Plan. All schedules include incremental steps toward compliance with applicable emission limitations.

1974

49398 **APTIC NO. 70591**

Asakawa, Teruhiko

AIR POLLUTION PROLEMS IN THE SOVIET UNION. *(Soren no taiki osen mondai). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 10(8):9-16, Aug. 1974, 6 refs.*

The historical background of laws and regulations concerning environmental protection beginning with the first control regulation issued on June 25, 1935 are reviewed. In the Soviet Union, the administration of environmental protection is under the jurisdiction of the Ministry of Health rather than an independent administrative agency such as the Environmental Agency of Japan or the Environmental Protection Agency of U.S.A. The description of four basic environmental protection laws, the Nature Protection Law, Health Law, Land Law, and Water Resource Law and three major sources of atmospheric pollution, industries, TETs (thermal power stations), and automotive exhaust emission are given. For the control of industrial exhaust emissions, a dust collector is used. For the other pollutants, however, control is largely dependent on the atmospheric dispersion method by means of high smoke stacks. The uniqueness of the Soviet thermal power station is that it supplies hot water and hot water heating as well as electricity, which is called TETs. The long history of TETs which began in 1924 and its present status are reviewed with a description of advantages and related pollution problems. The pollution control system is based on the permissible concentration, and neither the total emission control regulations nor the emission control standard are used. Some of the atmospheric pollution control measures taken are described.

49399 **APTIC NO. 70430**

Berry, Brian J. L., Andrew S. Bruzewicz, Douglas B. Cargo, James B. Cummings, Donald C. Dahmann, Peter G. Goheen, Charles P. Kaplan, Dorothy B. Koopman, Richard F. Lamb, Lee F. Margerum, Marvin W. Mikesell, David J. Morgan, Jack P Mrowka, John P. Piccininni, and Judith A. Soisson

LAND USE, URBAN FORM AND ENVIRONMENTAL QUALITY (FINAL REPORT). *Chicago Univ., Ill., Dept. of Geography, Environmental Protection Agency Proj. R-801419, Research Rept. 155, 463p., 1974. 144 refs.*

A study of the relationship between land use and environmental quality (air, water, and land) is presented. Air quality topics considered include: pollutant measurement systems (National Air Surveillance Network, Continuous Air Monitoring Project, state reports, air quality control region sampling networks, and urban emission inventories); emission sources and statistical models of city characteristics related to pollution; air quality assessment (Clean Air Standards and measures of achievement of standards); and the effects of air pollution on human health and welfare. Nationwide relationships of pollution to city characteristics are considered in terms of a nationwide data set, a pollution-sensitive typology of the urban regions, and the effects of agglomeration economies and environmental diseconomies on urban property values. Links between air pollution and land use maps are discussed in terms of mobility, time, and spatial units, generation of emissions, diffusion mechanisms, and air quality surveillance. The environmental consequences of alternative urban forms are also projected.

49400 **APTIC NO. 71269**

Caranci, Michael A. and E. M. Wrubleski

FARM CERTIFICATION AND APPROACH TO FARM ODOUR PROBLEMS IN ONTARIO. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 117-132. (March 18-19.)*

Farm odor problems in Ontario are reviewed in terms of environmental legislation, procedures related to the certification of farms, and abatement activities. The Environmental Protection Act of 1971 defines an acceptable level of odor intensity consistent with normal farm practice. Main sources of farm odors are the storage and spreading of manure and barn odors. In almost every case such problems are resolved by the following two steps: physical changes such as the addition of covered storage tanks and the minimization of moisture in manure and modifications in management practice. A Certificate of Compliance, jointly issued by the Ontario Ministries of the Environment and Agriculture and Food, is given to farm operators in compliance with the intent of the Environmental Protection Act.

49401 **APTIC NO. 71253**

Downing, Paul B. and William D. Watson, Jr.

COST-EFFECTIVE ENFORCEMENT OF ENVIRONMENTAL STANDARDS. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 23p., 1974. 6 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 67th, Denver, Colo., June 9-13, 1974, Paper 74-174.)*

Some of the differing impacts upon firm behavior of legal enforcement, economic incentive enforcement, and mixed legal-economic enforcement can be determined with information on cost-effective enforcement of environmental standards. The information can be used to identify enforcement systems which are most likely to minimize resource costs to firms and enforcement agencies for meeting environmental standards. A computerized model is used to simulate enforcement of the new source particulate matter discharge standard for coal-fired power plants. Under current legal enforcement, most plants will violate the standard, small plants will control to higher removal levels than large plants, and firms will install relatively costly pollution control technology. Three enforcement alternatives are considered for overcoming these problems: more stringent legal enforcement, economic incentive enforcement using effluent taxes, and a mixed system which uses device certification tests and effluent taxes. Each of these alternatives can lead to the standard being met and to more-or-less equal sharing in control burden across plant size. It is, however, only the two systems which use effluent taxes that give incentive for choosing least costly control technology. The two enforcement systems which use effluent taxes probably would encourage adoption of least cost control technology. This is likely to be a desirable outcome since it may lead to minimum resource costs to power plants and pollution control agencies of meeting fly ash standards. The general applicability of this conclusion to other enforcement situations is discussed. (Author abstract)

49402 **APTIC NO. 70546**

Fujiwara, uheita

AN OSERVATION OF THE POLLUTER-PAYS PRINCIPLE (PPP)---DISCUSSIONS OF THE OECD ENVIRONMENTAL COMMITTEE. *(Osensha futan no gensoku (PPP) ni tsuite no ichikosatsu---OECD kankyo iinkai no giron o chushin ni). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 10(8):1-8, Aug. 1974.*

The background and circumstances for adopting the Polluter-Pays Principle (PPP) for the cost of remedying environmental problems by OECD (Organization for Economic Cooperation and Development) is described. The recommendations of the Council on the Guiding Principles Concerning International Economic Aspects of Environmental Policies adopted on May 26, 1972 concerning the cost allocation, environmental standards, national treatment and non-discrimation, procedure of control, compensating import levies, and export rebates is summarized. The Note on the Implementation of the PPP adopted at the November 27-29, 1973 Meeting concerning the definition of PPP, instruments for applying the PPP, and exceptions to the PPP is also summarized. The PPP is based on the theoretical premise of the statistical market, the substitution of product or service, and internationally unified role sharing for pollution measurement (both publicly and privately). This premise is discussed in reference to the Japanese pollution control laws, finance, taxation system, and participation of industries in pollution control measures.

49403 **APTIC NO. 70606**

Gorczyca, Miroslaw

ENVIRONMENTAL PROTECTION IN EAST GERMANY. *(Ochrona srodowiska naturalnego w Niemieckiej Republice Demokratycznej). Text in Polish. Gaz, Woda i Tech. Sanit. (Warsaw), 48(4):124-127, 1974. 6 refs.*

Problems posed by air pollution to ecology and measures taken to protect the environment of East Germany are presented. The economic damage caused by air pollution was estimated as being 50% damage caused by corrosion and other factors. In 1972 the chemical industry invested $80,000 in abatement installations concentrated in the Halle industrial region, where 45% of the chemical, 40% of the cement, and 35% of the metallurgical industries are located, and where 25% of the electrical energy is generated. The Meteorological ureau performs an information, preventive, control, and repressive activity concerning the tresspassers causing air pollution. Use of natural gas increased from 1,000,000,000 ton in 1970 to 7,000,000,000 tons in 1973. Carbon dioxide emissions will decrease by 2,000,000 tons, sulfur dioxide emissions by 300,000 tons, and dust emission by 200,000 tons. All new industrial facilities generating electrical energy must have an abatement installation with a dust retaining efficiency of 97 to 99%. The construction of new filtering and scrubbing installations and reconstruction of old ones on plant chimneys cost $16,000,000 in 1972. Areas of East Germany are being zoned into environmental protected areas. There is an excellent atmosphere of cooperation between scientists and industry in East Germany, favorizing environmental protection.

49404 **APTIC NO. 70892**

Grobecker, Alan J.

RESEARCH PROGRAM FOR ASSESSMENT OF STRATOSPHERIC POLLUTION. *Acta Astronaut., vol. 1:179-224, 1974. 33 refs.*

The U. S. Dept. of Transportation program to determine the regulatory constraints necessary to safeguard that future flights in the stratosphere do not result in adverse environmental effects is discussed. The Climatic Impact Assessment Program (CIAP) considers the impact on people, plants, and animals of climatic changes resulting from perturbing the upper atmosphere by the upper atmosphere by the propulsion effluents of a world high-altitude fleet as projected to 1990. The program will provide a report on the impact of climatic changes which will take into account both socio-economic concerns and the possibility of applying technology and regulations to alleviate those concerns. The CIAP s initial output was a set of six monographs which are compilations of data in the areas suggested by their titles: The Natural Stratsphere, The Engine Emissions in the Stratosphere of 1990 A.D., The Perturbed Stratosphere of 1990 A.D., The Perturbed Troposphere of 1990 and 2020 A.D., The Biological Effects of the Tropospheric Changes, and The Social and Cost Measures of the Biological Changes. The conclusions will appear in the Report of Findings which will draw upon the data presented in the monographs. The physical science concerns of CIAP center on the possible depletions of ozone as a result of interactions between engine exhaust emissions and naturally present stratospheric constituent; consequent changes in ultraviolet reaching the earth s surface as a result of ozone depletion; and possible changes in heating at the earth s surface caused by the formation of stratospheric aerosols from aircraft emissions or by the injection of carbon dioxide and water vapor into the stratosphere from aircraft emissions. Biological and economic concerns of CIAP have to do with changes in agricultural, forest, and marine productivity or effects on human health and their economic consequences. The CIAP also takes into account the need for theoretical modeling of atmospheric processes, projections of stratospheric aircraft fleet size and traffic, the development of programs to ascertain that predicted impacts are verified, and the development of regulatory programs to control total stratospheric emissions. (Author abstract modified) development of regulatory programs to control total stratospheric emissions. (Author abstract modified)

49405 **APTIC NO. 71419**

Hansler, G. M.

PUERTO RICO. APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 39(243):43640-43641, Dec. 17, 1974.*

Proposed compliance schedules for Puerto Rico are announced. Each schedule will establish a new date by which the source involved must comply with the applicable emission limitation provisions of the Federally approved state implementation plan. No final compliance dates fall beyond the April 30, 1975 date established in Puerto Rico s implementation plan for attainment of primary ambient air quality standards, nor is relaxation of any emission limitation or standard involved. Achievement of ambient air quality standards by the attainment date will not be jeopardized by approval of these schedules. Public comment is invited.

49406 **APTIC NO. 71359**

Ikari, K. and K. Wakiyama

ON SULFUR OXIDES AND CLIMATE IN KARATSU AREA. *(Karatsu chiku ni okeru iosankabutsu osen to kisho). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):521, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 369.)*

Control of sulfur dioxide by a telemeter system in the Karatsu area is reported. The areal SO2 is mainly caused by a big power station which is located at the south end of the Karatsu bay. Whenever a northerly sea wind blows, a higher SO2 level is noted in the town. The area uses eleven stations to monitor the SO2 level, and a change of fuel to one containing sulfur is ordered whenever a high SO2 level is recorded at the monitoring stations which are located semicircularly to the south of the power station. These stations detect the high SO2 regardless of the direction of any northerly winds causing a high level in the town. The results of SO2 control by the telemeter system are compared in terms of wind direction, wind velocity, SO2 level in town, and SO2 emission rate at the power station. The system controls the SO2 level in the town to an average of 1.2 pphm, (more than 3 pphm has never been observed).

49407 **APTIC NO. 70445**

Jarrault, P.

LEGISLATION IN FRANCE CONCERNING THE PREVENTION OF AIR POLLUTION BY STATIONARY SOURCES. *(La legislation francaise relative a la prevention de la pollution atmospherique par les sources fixes). Text in French. Inst. Francais des Combustibles et de l Energie, Paris (France), C.I.T.E.P.A. Etudes Documentaires 41, 77p., 1974 (?).*

An exhaustive review is given of the air pollution prevention-related legislation in France. Technical instructions concerning emission abatement and emission standards imposed in different industries, such as energy production, petroleum refineries, combustion equipment, waste incinerators, cement works, surfac treatment industry, ore-dressing plants, foundries, and oxygen converters are presented. Instructions for the calculation of the stack height and discharge rate for combustion equipment are given. The maximum allowable dust emission in cement works is limited to 150 mg/cu m, with a highest emergency limit of 0.5 g/cu m. The use of fuel oils with sulfur content below 2% and of solid fuels with volatile matter content in excess of 15% is prohibited in newly created special protection zones. The sulfur dioxide and black smoke concentrations will be monitored by monitoring stations to be established primarily in highly polluted industrial and residential areas. Special financial incentives, such as accelerated write-off, are offered industries investing in emission control, while obsolete facilities, especially when located in urban and developing areas, are required to be shut down.

49408 **APTIC NO. 71219**

Kapp, K. William (ed.)

ENVIRONMENTAL DISRUPTION: CHALLENGE TO SOCIAL SCIENCE. *In: Environmental Policies and Development Planning in Contemporary China and Other Essays. K. William Kapp (ed.), Paris, Mouton, 1974, Chapt. 2, p. 57-75. 24 refs.*

The challenge of environmental disruption to social science is discussed. Problems considered include: the difficulty of measuring costs and benefits of environmental control, the distinction between what is essential annd less essential to society, and the inadequacy of remedial measures such as taxation in supplying adequate incentives for pollution control. A line of attack directed towards the design and technique of production is proposed, with emphasis on new input mixes and the location and design of production processes. The design of a central heating unit using garbage as input and sited favorably in terms of meteorological effects on air pollution is used as an example of such an approach.

49409 **APTIC NO. 71264**

Mobley, Hugh E.

AIR POLLUTION REGULATIONS AND THEIR EFFECT ON FOREST MANAGEMENT. *Air Pollution Control Assoc., Pittsburgh, Pa., Southern Section and Technical Council, Control Technol., Agric. Air Pollut., Memphis, Tenn., 1974, p. 29-38. (March 18-19.)*

The effect of state regulations for smoke control on open-burning practices in forest management is reviewed. Some restrictions apply to open burning in all of the northeastern states, and such burning is completely prohibited in some smoke-sensitive areas. Initial conflicts between air pollution permits and fire control permits are substantially resolved. Regulations in the western states generally follow those in the northeastern states and are based on the amount of pollutants given off by the material when burned, meteorological conditions, the need for open burning, and alternative methods of disposal. All southern states have restrictions on open burning, and generally the regulations prohibit all open burning with specific listed exceptions. When burning is the only feasible method of forest control, some southern states issue special permits. On a national basis, refuse disposal burning, which includes agricultural and forest burning, accounts for an estimated 3% of the total load of major air pollutants.

49410 **APTIC NO. 71020**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. KANSAS: APPROVAL OF IMPLEMENTATION PLANS. *Federal Register, 39(240): 43278-43279, Dec. 12, 1974.*

Compliance schedules submitted by the state of Kansas as proposed revisions to the state implementation plan and approved by the Environmental Protection Agency are listed. Each approved revision establishes a new date by which the individual source must comply with the applicable emission limitation in the federally approved state implementation plan. The schedules are listed by source, location, regulation involved, date adopted, effective date and final compliance date. Evaluation reports prepared by the EPA for each compliance schedule are available for public inspection.

49411 **APTIC NO. 71030**

Quarles, John

REGULATION OF FUELS AND FUEL ADDITIVES. LIABILITY OF BRANDED REFINERS. *Federal Register, 39(235):42356-42361, Dec. 5, 1974.*

Proposed amendments to provisions of section 80.23 regarding the liability of branded refiners for unleaded gasoline contamination at the retail pump are promulgated based on comments of interested parties and a review of section 80.23 by the United States Court of Appeals for the District of Columbia Circuit (Amoco Oil Incorporated versus the Environmental Protection Agency). Under a proposed amendment, the branded refiner is not deemed in violation if he shows that the violation at the retail outlet is not caused by himself and that reasonable efforts were made to ensure compliance with contractual undertakings involving the sale of unleaded gasoline. An amendment to section 80.23 is also proposed to state that branded resellers, like distributors of unbranded gasoline, are in violation of section 80.22 for causing or allowing the introduction of unleaded gasoline into vehicles requiring unleaded gasoline. Another proposed amendment defines the responsibilities of distributor-carriers with respect to section 80.21.

49412 **APTIC NO. 71031**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. ARIZONA: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 39(240): 43277, Dec. 12, 1974.*

Compliance schedules submitted by 20 stationary sources in the state of Arizona in connection with implementation of particulate matter controls and approved by the Environmental Protection Agency are listed. Each approved revision establishes a new date by which the individual source must comply with the federally promulgated emission limitation. The listing includes the source, location, regulation involved, effective date, and final compliance date. Copies of the complete schedules and evaluation reports prepared by the EPA for each source are available for public inspection. One stationary source not listed is already in compliance with the particulate matter regulations, and 11 others are required to be in compliance with the regulations by the date of publication of this listing.

49413 **APTIC NO. 71032**

Quarles, John

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. KANSAS: APPROVAL OF COMPLIANCE SCHEDULES. *Federal Register, 39(240): 43279-43281, Dec. 12, 1974.*

Compliance schedules submitted to the Environmental Protection Agency by the state of Kansas as proposed revisions to approved state implementation plans are listed. Each revision establishes a new date by which the individual source must comply with the applicable emission limitation in the federally approved state implementation plan. No comments concerning the schedules listed were received during a 30-day comment period after proposed approval by the administrator, and the schedules are thus approved. Each schedule is listed by source, location, regulation involved, date adopted, effective date, and final compliance date. Evaluation reports prepared by EPA for each compliance schedule are available for public inspection.

49414 **APTIC NO. 70759**

Ravan, Jack E.

KENTUCKY. APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. *Federal Register, 39(235):42377-42379, Dec. 5, 1974.*

A regulation providing a categorical compliance schedule for indirect heat exchanger sources of sulfur dioxide in the Commonwealth of Kentucky is proposed and offered for public comment by the Environmental Protection Agency Administrator. The proposed compliance schedule requires that sources not presently in compliance with Kentucky Air Pollution Control Regulation AP-4, Section 1.(2), 2.(3), or 1.(4) take specific action to achieve compliance by the dates specified in the state regulation. A source that is in compliance may be exempted from such action only by certifying compliance to the administrator by March 15, 1975. Notice of a public hearing on this proposal is given elsewhere in this Federal Register issue, and interested persons may participate in this rulemaking by submitting written comments to the Regional Administrator of the EPA. All comments are available for public inspection.

49415 **APTIC NO. 71029**

Stern, Arthur C.

AIR QUALITY ISSUES OF THE DAY: CHANGING PERSPECTIVES. *Clean Air (J. Clean Air Soc. Australia New Zealand), 8(3):51-52, 62, Aug. 1974. 23 refs.*

The best practical means approach versus the air quality management approach to air pollution control is discussed along with the setting of air quality standards. The best practicable means approach which applies the best available control technology to air quality control involves two troublesome assumptions: the full-scale, long-term practicality of processes tested at less than full-scale and for very few operating hours, and the equal practicality of a given control for related processes. The air quality management approach involves first promulgating an air quality standard based on the effects of air pollution on receptors and then computing emission standards. Problems involving the interpretation of health effects data in terms of thresholds and dose-response relationships limit the setting of reasonable air quality standards and thus the air quality mangement approach to control. The use of mathematical models to establish emission standards from air quality standards is also limited in terms of deciding what percentage of the air quality standard is to be introduced as input data. A computation that allocates 100% of the air quality standard to a source or class of sources preempts meteorolgical considerations such as absorptive and dispersive capacities of the atmosphere. A benefits maximization approach to air pollution control is suggested as an alternative to present control strategies.

49416 **APTIC NO. 70754**

Train, Russell E.

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. NEW YORK; COMPLIANCE SCHEDULE REVISION. *Federal Register, 39(229):41253-41254, Nov. 26, 1974.*

Compliance schedule revisions in the New York State implementation plan are approved by the Environmental Protection Agency Administratior in a notice of final rulemaking. The revisions assure that increments of progress are provided for fuel burning sources in the Niagara Frontier Region as part of New York s control strategy for sulfur dioxides. Part 226 of Subchapter A, Chapter III, Title 6 of New York s Official Compilation of Codes, Rules and Regulations imposes a sulfur in fuel limitation on fuel burning sources until October 1, 1975 when a more stringent limitation will be imposed. An immediately effective periodic reporting requirement on all major fuel distributors is also imposed.

49417 **APTIC NO. 70756**

Train, Russell E.

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. APPROVAL OF PLAN REVISIONS; IDAHO. *Federal Register, 39(229):41253, Nov. 26, 1974.*

Approval is granted by the Environmental Protection Agency Administrator revisions submitted by the state of Idaho on August 15, 1973. The revisions include legislative amendments to Idaho legal authority along with an accompanying Attorney General s opinion regarding their adequacy as compared to the requirements of 40 CFR Part 51.11. Disapproved is the provision of Section 39-111 of the Idaho Code relating to the legal authority to make emissions data available to the public. Section 39-111 does not comply with the requirements of 40 CFR 51.11(a)(6) is that public availability of source emissions data is not assured.

49418 **APTIC NO. 71036**

Train, Russell E.

APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS. PREVENTION OF SIGNIFICANT AIR QUALITY DETERIORATION. *Federal Register, 39(235):42510-42517, Dec. 5, 1974.*

State implementation plan regulations proposed by the Environmental Protection Agency Administrator on August 27, 1974 in response to a District Court (District of Columbia) ruling that the current Clean Air Act requires the Administrator to prevent significant air quality deterioration are reviewed along with public comment and changes to the regulations. The regulations proposed on August 27, 1974 called for the establishment of classes of different allowable incremental increases in total suspended particulates and sulfur dioxide. A preconstruction review of specified source categories was proposed as the method for determining whether sources would cause a violation of the appropriate increments. The new source review also included a provision requiring the use of best available control technology on sources covered by the regulation. Also provided were procedures for public comment on each application for permission to contruct and for delegating the responsibility for implementing the new source review procedures to states or local governmental units. Changes to the regulations are outlined with respect to the following: definitions for modified source, best available control technology, and baseline air quality concentration; conditions for applying for redesignation oof areas; state reclassification of Federal and Indian lands; public comment on proposed redesignations; preconstruction review and best available control technology for Class III areas; the determination of allowable air quality increment; EPA review of state redesignations; specification of emission limitation; responsiblity for performing air quality impact analysis; procedures for public participation; and sources subject to review.

49419 **APTIC NO. 70796**

Tsunakawa, Masao

GOVERNMENTAL PROJECTION FOR ATMOSPHERIC PROTECTION, CASE OF TOCHIGI PREFECTURE. *(Tochigi ken no taiki hozen gyosei no suishin ni tsuite). Text in Japanese. Kankyo Sozo (Environ. Creation), 4(12):45-52, Dec. 1974.*

The industrial development in Tochigi Prefecture has far exceeded the 10 year development plan set in 1970, and the problems of environmental pollution including photochemical smog and acid rainfall are widespread. The basiic pollution control plan formulated for the 1973-1980 period which includes the environmental protection administrative system, pollution monitoring and investigation system, pollutant source control measures, pollution control devices and facilities, handling system for pollution complaints and disputes and solid waste treatment systems is described. The status of air pollution and incidence of pollution related afflictions is discussed based on the data compiled. The administrative approaches to promoting the above-mentioned six basic policies for environmental protection are discussed.

49420 **APTIC NO. 71335**

Vaysman, Y. I., N. V. Zaytseva, A. V. Mikhaylov, V. F. Petrov, and T. V. Chupina

THE USE OF PUNCHED CARDS IN AN AIR POLLUTION STUDY OF RESIDENTIAL AREAS. *(Primeneniye nerfokart pri izuchenii zagryaznenii atmosfernogo vozdukha naselennykh mest). Text in Russian. Gigiena i Sanit., no. 10:90-91, 1974.*

The punched card system adopted for information processing and data storage in an air pollution monitoring network in an industrial area in the USSR is described. The monitored pollutant concentration data along with averaged meteorological parameters with indications of the most frequent values are stored on punched cards which contain additional information, such as the site and time of the monitoring, the distance from the emission source to the monitoring site, the actual meteorological conditions, and the maximum allowable single-time and daily average concentrations.

49421 **APTIC NO. 70674**

Werczberger, Elia

IMPLICATIONS OF AIR POLLUTION FOR THE SEPARATION AND MIXTURE OF LAND USES. *Isr. J. Technol., vol. 12:99-104, 1974. 4 refs. (Presented at the Israel Ecological Society, Scientific Conference, 4th, April 1973.)*

The implications of air pollution on the location of land uses which differ with regard to pollutant emission rate and sensitivity to pollution are discussed. Assuming that there are only two sites with an unlimited supply of land, no segregation of activities will result in market equilibrium. If land constraints are effective, there will be an incentive for the activity with the lower emission rate per acre to initiate a local policy which excludes the other activity. However, if such a policy is not identical with the market equilibrium, it will be inferior in terms of total pollution costs. Thus, while local discriminatory policies reduce the cost to a limited population, they are, in terms of overall welfare, not superior to the market equilibrium and may be inferior. (Author abstract modified)

49422 **APTIC NO. 70511**

Wohlgemuth, R.

CONSIDERATIONS CONCERNING A PRAGMATIC TAX STRATEGY WITH REGARD TO AN ENVIRONMENT ORIENTED ENERGY POLICY - ENVIRONMENTAL PROTECTION TAX AS ALTERNATIVE TO REGULATIONS. *(Ueberlegungen zu einer pragmatischen Gebuehrenstrategie im Rahmen einer umweltorientierten Energiepolitik - Umweltgebuehren als Alternative zur Auflage). Text in German. rennstoff-Waerme- Kraft, 26(12):491-494, Dec. 1974. 13 refs.*

After a critical review of the present regulations imposed on power plants with the purpose of reducing emissions, the environmental protection tax is described as an alternative. Introduction of such a tax would leave a great deal of uncertainty concerning its effect. For reduction of this uncertainty a tax simulation model has been developed which, by using the example of the sulfur dioxide emissions from power plants, attempts to find the required tax height for guaranteeing a certain pre-determined emission level. The described environmental protection tax would lead to substitution processes between individual (more or less polluting) energy carriers and production processes. The extent of the tax-induced substitutions can be expressed by cross price elasticities (a parameter measuring the relative quantity change of a merchandise X as a consequence of the relative price change of merchandise Y) which must be empirically determined.

49423 **APTIC NO. 70400**

Environmental Protection Agency, Washington, D. C., Office of Research and Development

EXPRO-75: A LISTING OF EXTRAMURAL PROJECTS TO BE FUNDED IN FISCAL YEAR 1975. *219p., July 1974.*

Research problems in the field of environmental quality for which funding by the EPA may be available are described. There are 10 program areas including air pollution. This program aims to assure the availability of control devices, processes, and approaches for control of air pollutants at their source. Control technology activities are grouped into these areas: sulfur oxides, nitrogen oxides, particulates, hazardous and other pollutants. Emphasis is placed on control of SOx from electric power generating plants. The primary thrust of NOx research and development is in the area of combustion control. Increasing attention is being given to control in NOx effluent treatment processes. Reliable methods for measuring fine particulates, as well as the development of high efficiency methods and equipment for controlling fine particulates in the 0.05 to 3.0 micron size, are being emphasized. The hazardous and other pollutant control category includes the development of technology for control of hydrocarbons from stationary sources, halides, and similar pollutants. Special emphasis is placed on the control of hazardous pollutants such as mercury, beryllium, asbestos, cadmium, vanadium, chromium, and lead.

49424 **APTIC NO. 70435**

National Society for Clean Air (England)

AN OUTLINE OF THE LAW RELATING TO AIR POLLUTION. *In: The Clean Air Year Book for 1974. 1974, p. 22-41.*

The control of air pollution in Great Britain is essentially a team effort involving Local Authorities, the Department of the Environment (including the Alkali Inspectorate), Police Authorities (with respect to road vehicle emissions), and the Factory Inspectorate (with respect to dusts and toxic fumes in factories). Regulations and legislation controlling air pollution are reviewed. The principal legislation enforced by local authorities in Great Britain (excluding Northern Ireland) is contained in the Clean Air Acts of 1956 and 1968, but some of the nuisance provisions of the Public Health Act of 1936, extended and amended by the Public Health Act of 1961 and the Public Health (Recurring Nuisances) Act of 1969, are applicable in specified circumstances. The main provisions of the Clean Air Acts and supporting Acts are reviewed for the main subjects of smoke, chimney heights, grit, dust, and fume, and miscellaneous provisions. Aspects such as emission standards, fuel standards, grant arrangements, and certificates of registration for certain industries are reviewed.

49425 **APTIC NO. 70575**

POLLUTION HEALTH DAMAGE COMPENSATION LAW ENFORCEMENT PROCEDURES AND REGULATIONS. *(Kogai kenko higai hoshoho shikorei, kisoku) Text in Japanese. Kankocho Kogaisenmon Shiryo (Public Nuisance Gaz.), 9(5):3-35, Sept. 1974.*

An outline of the Japanese pollution-caused health damage compensation law enforcement procedures and regulations, the conten of the entire ordinance No. 295, the amount of compensations, the degrees of damages, the areas subject to pollution and eligibility, and application methods are described. The areas subject to the ordinance are parts of Yokohama and Kawasaki in Class I (Air Pollution), and parts of Niigata and Toyama in Class II (Water pollution). The types of diseases covered by Class I are chronic bronchitis, bronchial asthma, asthmatic bronchitis, emphysema, and deuteropathy to these diseases. As a resident requirement for eligibility, the claimant should have lived in the area for two years for chronic bronchitis and deuteropathy, and one year for bronchial asthma, asthmatic bronchitis, and deuteropathy, and three years for emphysema and deuteropathy; these requirements also apply to commuters. The effective period is three years for chronic bronchitis, bronchial asthma, emphysema, and deuteropathy, and two years for asthmatic bronchitis and deuteropathy. For those receiving compensation, reevaluation of damage is due in one year. The compensation period for the surviving families is 10 years. A pollution emission tax is charged to those industries exceeding a certain amount of emissions. The taxable scale of emission sources in pollution control areas are plants with the maximum gas per hour of more than 5000 cu m, and in other areas, more than 10,000 cu m. The tax unit is 1 cu m of SOx obtained by converting emission at temperature zero and pressure one, and the charges are 5 cents in control areas and 1/2 cent in other areas per 1 cu m

49426 **APTIC NO. 70795**

COUNTERMEASURES AGAINST POLLUTION IN TOCHIGI PREFECTURE. *(Tochigi-ken no kogai to taisaku). Text in Japanese. Kankyo Kenkyu (Environ. Studies), no. 8:60-69, Nov. 1974.*

With rapid industrial development, the number of pollution complaints registered increased to 1082 cases in 1972, which was 219 cases more than the previous year. The characteristics of pollution problems in Tochigi and the prospects for pollution control are discussed. On the categories of water pollution, air pollution, noise pollution, malodor pollution, solid waste treatment and others, the present status is reviewed with data compiled, and control measures are described in reference to the 1973 environmental protection plan based on six basic policies concerning environmental protection administrative systems, pollution monitoring and investigation systems, pollution control devices and facilities, pollution source control measures, handling systems for pollution complaints and disputes, and industrial waste treatment systems.

49427 **APTIC NO. 70900**

Environmental Protection Agency, Research Triangle Park, N. C., Chemistry and Physics Lab.

ANNUAL REPORT. CHEMISTRY AND PHYSICS LABORATORY (FINAL REPORT). *124p., Oct. 1974. 397 refs.*

Activities of the Chemistry and Physics Laboratory of the Environmental Protection Agency are outlined. Funding summaries are given for fiscal years 1971-1974, active and completed contracts, grants, and interagency agreements, and publications supported by intramural funds. The laboratory conducts an intramural and extramural research program which provides: techniques and instrumentation for the measurement of atmospheric pollutants (particulates and gases), information on the chemical and physical transformations that pollutants undergo in the atmosphere, and information on the effects of atmospheric pollutants on materials. Specific activities include: emission source testing (dynamometer testing of vehicular pollutants), wind tunnel simulations of stack emissions, microscopic characterization of particulate matter, photochemical model development, kinetic model verification, laser spectroscopic analysis of various gaseous air pollutants, and the determination of oxidant/precursor relationships for control strategies.

49428 **APTIC NO. 71247**

Dept. of the Environment, London (Great Britain)

CLEAN AIR TODAY. *London, 48p., 1974. 13 refs.*

Great Britain's progress in air pollution control is reviewed against the background of clean air legislation and enforcement policies instituted. Topics covered include: the history of air pollution in Great Britain, the activities of the Alkali Inspectorate, the control of non-registered industries, domestic smoke control, motor vehicle emissions, sulfur dioxide pollution, pollution monitoring activities, and the effect of air pollutants on human health. With the passage of the Clean Air Act in 1956, smoke emissions from domestic sources are being effectively controlled. The Greater London Area is over 90% covered by smoke control orders. December sunshine in London is now 70% greater than 20 yr ago. The northeast section of England, however, remains with less than 50% coverage by smoke control orders. New regulations for the control of carbon monoxide, hydrocarbons, and smoke are being applied to currently manufactured motor vehicles, and the government is sponsoring an evaluation program on a filter designed to reduce vehicular lead emissions. Sulfur dioxide emissions from domestic sources are steadily declining, while emissions from power stations are rising. Industrial SO2 emissions appear to be unchanged over the last 20 yr. Smoke and sulfur dioxide are currently being monitored at about 600 sites in England and Wales. Many local authorities are also operating deposit gauges for measurements of dust and other settling particulates. The correspondence between periods of relatively high air pollution and higher mortality and morbidity rates has virtually disappeared with the implementation of the Clean Air Acts.

1973

49429 **APTIC NO. 70394**

Hinton, Merrill G., Toru Iura, and Joseph Meltzer

EXAMINATION OF ISSUES RELATED TO TWO-CAR REGIONAL EMISSION CONTROL STRATEGIES: VOLUME II - TECHNICAL DISCUSSION (FINAL REPORT). *Aerospace Corp., El Segundo, Calif., Environmental Protection Agency Contract 68-01-0417, Rept. EPA-460/3-74-029-b, ATR-73(7324)-1, 241p., April 1973. 34 refs.*

NTIS: PB-239 689/AS

The effects of a 2-car regional emission control strategy (wherein a low-emission car would be used in all areas of the U. S. where automotive pollution is a serious local problem and a high-emission car would be used in the rest of the nation) implementation on air quality were determined. Under a 1-year California-only 2-car strategy or a California-plus 2-car strategy there is no dramatic improvement in air quality in the control regions with the lower emission cars. The regions would have approximately 10% (1-3 ppm) reduction in carbon monoxide and an approximately 5% (0.001-0.02 ppm) reduction in oxidant level beyond the level that would result if only 1974 emission standards were in effect throughout the 1975 model year. In terms of oxidant level reduction benefits resulting from compliance with 1975 emissions standards, California would benefit the most by being a control region.

49430 **APTIC NO. 70408**

Suess, Michael J.

AIR QUALITY MANAGEMENT ACTIVITIES IN THE PROGRAMME OF THE WHO REGIONAL OFFICE FOR EUROPE. *Preprint, p. 25-30, 1973. (Presented at the World Meteorological Organization/World Health Organization Technical Conference on the Observation and Measurement of Atmospheric Pollution, Helsinki, Finland, July 30-Aug. 4, 1973.)*

In its attempt to respond to the growing need and demand for more and more sophisticated air pollution control programs in Europe, the World Health Organization (WHO) Regional Office for Europe in Copenhagen has, as part of its intercountry long-term program on environmental pollution control, developed a long-term program for the air pollution control sector. A second group of activities on this subject has been generated in the form of comprehensive country-sponsored environmental projects financed by the United Nations Development Program, for which WHO acts as an executive agency. These programs are reviewed. The long-term program includes development of a manual on air quality management, development of a manual on industrial air pollutants, and a study on the long-term effects of air pollution on health. The second group of country-sponsored projects includes projects in Poland, Czechoslovakia, Romania, Yugoslavia, Greece, Spain, and Turkey.

49431 **APTIC NO. 70404**

Willis, Bryon H., James R. Mahoney, and John C. Goodrich

HACKENSACK MEADOWLANDS AIR POLLUTION STUDY - AIR QUALITY IMPACT OF LAND USE PLANNING (FINAL REPORT). *Environmental Research and Tech., Inc., Lexington, Mass., Office of Air and Waste Management Contract EHSD 71-39, ERT Proj. P-244-4, EPA-450/3-74-056-c, 148p., July 1973. 29 refs.*

NTIS: PB-239 728/AS

The procedures developed for considering air pollution in the planning process and the use of the procedures to evaluate four alternative land use plans for the New Jersey Hackensack Meadowlands for 1990 are described. Factors that have primary influence on regional air pollutant concentrations and spatial patterns are the mix, location, and intensity of land use activities. The relationship of these plan design factors to regional air quality is discussed. The land use category designated as manufacturing has a dominant influence on particulates, sulfur dioxide, and nitrogen oxides concentrations levels and patterns. Regional air quality is highly sensitive to manufacturing and transportation-related land use categories and is relatively insensitive to nearly all other land use categories. Land use intensity is an important consideration as a plan design factor which influences regional air quality levels. The primary impact of variations in land use intensity will occur in terms of the impact of pollutant levels on specific receptors as a result of limiting the number of receptors affected with the plan or within a specific region of the plan.

1972

49432 **APTIC NO. 70442**

Johnson, James T., Charles Hollifield, Darryl Hardin, Bryce Callaway, John Kelly, Craig Kneisel, Larry Lester, Bert Taylor, Dorothy Waldrup, Lionel Williams, and J. William Futrell

PROJECTION ON AIR POLLUTION CONTROL THROUGH COMMON LAW PLEADING. *Alabama Univ., University, School of Law, Environmental Protection Agency Contract 68-01-0546, 148p., Sept. 1, 1972.*

NTIS: PB 231339

The enforcement of the Alabama Air Pollution Control Act through common law pleading is discussed. The Alabama Air Pollution Control Commission is a coordinator of the state program and its relationship to Federal agencies is discussed. The procedures which municipalities and county Boards of Health must follow to adapt their own local air pollution programs, and the possibility of supplementing the Division of Air Pollution Control effects by a municipal reference ordinance system, are described. Other topics include: theoretical problems of pleading in air pollution enforcement suits in Alabama; form complaints for initiation of court actions; form complaints and supporting affidavits drawn to illustrate enforcement of the Commission's orders in an air pollution emergency situation; and a ready reference index of the various violations and types of enforcement actions which may be initated under the Act.

49433 **APTIC NO. 70563**

Japan Environment Agency

POLLUTION RELATED DISEASES AND RELIEF MEASURES IN JAPAN. *35p., May 1972.*

Air pollution diseases and a system to provide medical allowances and benefits to victims are discussed. The diseases which may be both caused and aggravated by air pollution include chronic bronchitis, bronchial asthma, pulmonary emphysema, asthmatic bronchitis, and their complications. Relief for patients started in Yokkaichi City in May 1965. The Law concerning Special Measures for the Relief of the Pollution related patients, promulgated in Dec. 1969, transferred services that require nationwide uniform relief from the local authorities to the central government. Medical allowances and other relief were provided by the government under this Law since Feb. 1970. Upon application from a person with a designated disease who has lived in a designated area for a prescribed period of time, or is commuting to the area, the local Mayor makes the final decision whether to recognize the applicant as an officially designated patient, subsequent to hearing the opinions of the medical experts on the Pollution Victim Verification Committee. The designated patients are provided with medical expenses and allowances, including necessary transportation expenses, while they are receiving treatment for the designated disease. Minamota and Itai-itai diseases caused by mercury and cadmium water pollution, respectively, are also discussed.

SOCIAL ASPECTS

1974

49434 **APTIC NO. 71176**

Engen, Trygg

METHOD AND THEORY IN THE STUDY OF ODORS PREFERENCES. *In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.), New York, Academic Press, 1974, p. 121-141. 25 refs.*

Theories about odor preference, with particular reference to studies of odor judgment among children, are discussed in relation to the traditional psychophysical or organoleptic methods of odor measurement. Studies among 4-year-old children indicated that they like an odor simulating sweat (butyric acid) which older children disliked. Closer analysis of the data suggested that the most important change with age was not odor preference but a tendency to acquiesce. A follow-up study involving psychophysical scaling of pair-comparison data showed that in general the relative positions of odorants on a preference scale was the same for adults and children, though the range of values on a hedonic scale for the same odorants became increasingly smaller the younger the children were. Other studies with adults revealed that the pleasantness or unpleasantness of an odor depends to a large extent on the person's familiarity with the odor. Hence, odor preferences should be considered in light of the kind of learning paradigms that may explain how they are acquired. Traditional psychophysical methods of odor evaluation may not be sufficient if like or dislike of odors depends largely on cultural norms.

49435 **APTIC NO. 71218**

Kapp, K. William (ed.)

ENVIRONMENTAL POLICIES AND DEVELOPMENT PLANNING IN CONTEMPORARY CHINA. *In: Environmental Policies and Development Planning in Contemporary China and Other Essays. K. William Kapp (ed.), Paris, Mouton, 1974, Chapt. 1, p. 9-56. 130 refs.*

The relationship of development planning in contemporary China to environmental policies is analyzed against the background of cultural heritage and traditions, socio-economic policies and institutions, and the country's political system. Topics covered include: land use policies, the Chinese interpretation of the causes of environmental disruption, monetary calculation versus assessment of social use values, factual assessment and policy making, participatory planning of environmental policies, environmental regulations, and anti-pollution measures. Air pollution is a matter of particular concern in China, as evidenced by studies of the effects of iron and steel factory emissions on schoolchildren living in contaminated areas. Atmospheric measurements of sulfur dioxide and dust fall in industrial areas of China reveal nine-fold increases over control values for the former and three-fold increases for the latter.

49436 **APTIC NO. 71221**

Kapp, K. William (ed.)

ENVIRONMENTAL INDICATORS AS INDICATORS OF SOCIAL USE VALUES. *In: Environmental Policies and Development Planning in Contemporary China and Other Essays. K. William Kapp (ed.), Paris, Mouton, 1974, Chapt. 6, p. 127-138. 19 refs.*

Environmental indicators are discussed in terms of social awareness of the inadequacy of economic indicators to adequately express the actual material and qualitative conditions of human life. Current work on environmental indicators appears to require the selection and definition of environmental quality standards and criteria in terms that allow for the determination of social minima. The selection and definition of social needs and social use values based on an integrative knowledge of the system character of the environment is proposed.

49437 **APTIC NO. 71222**

Kapp, K. William (ed.)

THE DISRUPTION AND PROTECTION OF THE ENVIRONMENT: ECONOMICS AND POLITICS. *In: Environmental Policies and Development Planning in Contemporary China and Other Essays. K. William Kapp (ed.), Paris, Mouton, 1974, Chapt. 7, p. 139-148. 5 refs.*

The economics and politics of environmental disruption and protection are discussed. Topics covered include: the effect of the environment on working conditions, the unequal socioeconomic distribution of environmentally-disruptive effects, the origins of the environmental crisis, and the formulation of environmental policies. Policies of environmental protection require a shift in political structures to provide for greater public participation in the decision-making process, and the deterioration of the environment requires a radical change in traditional notions of what is economically justified, as well as a redirection of scientific and technological developments toward the maintenance of some ecological balance.

49438 ***APTIC NO. 71180***

Springer, Karl

COMBUSTION ODORS - A CASE STUDY. In: Human Responses to Environmental Odors. Amos Turk, James W. Johnston, Jr., and David G. Moulton (eds.), New York, Academic Press, 1974, p. 227-262. 14 refs.

Opinion surveys concerning diesel odor reduction were performed to investigate the efficacy of odor control measures in reducing public annoyance. Improved needle injectors substituted for old style crown valve injectors in test fleets of city buses powered by Detroit Diesel 6V-71E engines resulted in odor reductions of 1.7 D units (Turk kit). However, the public opinion reduction was only 16% according to a 1970 opinion survey. The fraction of people who found the odor objectionable was reduced by only about 10%. Thus, even though a sizable reduction in odor was effected by the improved injectors, it barely influenced public opinion. A reduction of three D units (from D-5 to D-3) was estimated as necessary to achieve significant reductions in public adverse responses.

GENERAL

1974

49439 **APTIC NO. 71505**

Binder, G.

PLASTIC MATERIALS FOR ENVIRONMENTAL ENGINEERING. *(Kunststoffe fuer die Umwelttechnk). Text in German. Kunststoffe, 64(10):568- 574, Oct. 1974. 23 refs.*

The uses of plastic materials in environmental protection are outlined. In an indirect way, plastic materials contribute to air pollution abatement when used for improved thermal insulation of buildings, and as a construction material for natural gas pipelines or for pipelines of remote heating plants. Apart from in suction devices and exhaust systems, plastic materials are used as filter tissues and filter packings (polypropylene, PVC, polytetrafluoroethylene), for droplet separators (polyethylene, polystyrene, polytetrafluoroethylene), and for scrubbers (fiberglass-reinforced polyester resin). Light-wegith, corrosion-resistant stacks made of fiberglass-reinforced polyester resin are used to improve the dispersion of waste gases.

49440 **APTIC NO. 71000**

Inoue, Eiichi

AIR POLLUTION AND AEROBIOLOGY. *(Air Pollution to Aerobiology). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 9(2):262, Nov. 1974. (Presented at the National Air Pollution Research Conference, 15th, Chiba, Japan, Nov. 6-8, 1974, Paper 121.)*

The term aerobiology is explained. Aerobiology is the study of biological effects of airborne substances such as aerosols or microorganisms. Collection techniques are discussed. The International Association for Aerobiology is under the auspices of the International Union of Biological Sciences.

49441 **APTIC NO. 71373**

Shirasawa, Tadao

COMPLICATION OF COUNTERMEASUREMENTS AND FUTURE TECHNOLOGICAL DEVELOPMENT IN POLLUTION CONTROL. *(Taisaku yoin no tayoka to gijutsu kaihatsu no hoko). Text in Japanese. Kagaku Kojo (Chem. Factory), 18(12):58-59, Dec. 1974.*

A general discussion is given of the effect of pollution on humans, countermeasures against emission sources, air pollution prevention, meteorological effects, and pollution analysis and measurements. Analysis of ppm and ppb orders of pollutants require very accurate and quick methods. Industries are obliged to provide data on pollution, which requires expensive equipment and experienced technologists. There are more than 400 companies who provide pollution measurement services.

49442 **APTIC NO. 71451**

Sigal, I. Y. and S. S. Nizhnik

STACK HEIGHT CALCULATION WITH RESPECT TO NITROGEN OXIDE EMISSIONS. *(Raschet vysoty dymovykh trub s uchetom vybrosa okislov azota). Text in Russian. Energ. Elektrif., no. 5:34-35, 1974.*

The high toxicity of nitrogen oxides as compared with other pollutants, such as carbon monoxide and formaldehyde, makes it necessary to calculate power plant stack heights with respect to the nitrogen oxides emissions. The calculation is based upon the nitrogen oxides concentration in the flue gases, which can be calculated by experimentally established formulas or statistical treatment of actual measurement data. For power plants burning sulfurous fuels, the nitrogen oxides emission is converted to a sulfur dioxide equivalent and added to the sulfur dioxide emission for stack height calculation. Power plant and boiler plant stack heights are now calculated with respect to the nitrogen oxides emissions in the USSR.

49443 **APTIC NO. 71462**

THE PRICE OF AFFLUENCE: A DISTURBED ENVIRONMENT. *(Preis fuer den Wohlstand: Gestoerte Umwelt). Text in German. Kunstst.- Berat., no. 12:743-744, 1974.*

General environmental problems resulting from population growth and affluence are discussed. The increase in energy demand, far surpassing the pace of the population growth, has led to considerable air pollution and a disturbed environment in certain highly civilized areas, such as Los Angeles. To prevent further deterioration of the environment due to harmful emissions, the emission level for industrial plants is limited, regardless of increasing plant capacity, calling for more efficient emission control facilities. Many of the maximum allowable air pollutant concentrations have been standardized without sufficient experimental groundwork; thus many concentration standards are either too low or too high hygienically, and some are technologically unfeasible. Recent emission limitations imposed in West Germany may lead to distortions in competition with foreign firms.

SUBJECT INDEX

A

ABATEMENT
49199, 49360, 49432, 49437

ABSORPTION (CONTROL)
48696, 48736, 48745, 48753, 48759, 48778, 48791, 48813, 48820, 48831, 48851, 48864, 48867, 48875, 48889, 48909, 48958, 49077, 49147, 49171, 49197, 49219

ABSORPTION (GENERAL)
48708, 48743, 48795, 48796, 48847, 48866, 48887, 48909, 48912, 48934

ACETIC ACID
49015, 49094, 49312

ACETONE
48752, 49312

ACETYLENES
48947, 49038

ACROLEIN
48759, 48957

ADAPTATION
49329

ADSORPTION (CONTROL)
48696, 48710, 48712, 48766, 48778, 48791, 48794, 48813, 48816, 48863, 48868, 48886, 48893, 48909, 48923, 48943, 48975, 48978, 49233

ADSORPTION (GENERAL)
48747, 48755, 48805, 48838, 48840, 48863, 48885, 48909, 48931, 48934

ADVECTION
49156

AERODYNAMICS
48697, 49217, 49237

AEROSOL ATOMIZATION
49017, 49223, 49228, 49336

AEROSOL DIFFUSION AND BROWNIAN MOTION
48719

AEROSOL PHENOMENA
48627, 48642, 48654, 48655, 48686, 48719, 48732, 48744, 48798, 48812, 48819, 48829, 48860, 48924, 48937, 48950, 48951, 48970, 48973, 48974, 48977, 48982, 48985, 48989, 48991, 49003, 49009, 49010, 49017, 49020, 49022, 49049, 49080, 49083, 49087, 49098, 49110, 49114, 49115, 49116, 49141, 49158, 49170, 49171, 49197, 49208, 49223, 49224, 49227, 49228, 49234, 49235, 49318, 49323, 49336

AEROSOLS
48642, 48745, 48792, 48861, 48928, 48951, 48967, 48970, 48977, 49011, 49020, 49022, 49061, 49063, 49065, 49080, 49087, 49099, 49110, 49140, 49146, 49170, 49171, 49172, 49173, 49197, 49198, 49203, 49208, 49213, 49214, 49215, 49218, 49223, 49227, 49228, 49234, 49259, 49282, 49297, 49316, 49317, 49318, 49322, 49323, 49336, 49440

AFRICA
49034

AGRICULTURAL CHEMICAL PLANTS
48876, 48906, 48923, 48930, 49100, 49349

AGRICULTURAL SERVICES
48626

AGRICULTURE INDUSTRY
48626, 48659, 48668, 48670, 48692, 48791, 48927, 49400

AIR CONDITIONING EQUIPMENT
48697, 48819, 48895

AIR POLLUTION EPISODES
49097, 49192, 49255, 49270, 49285, 49321

AIR POLLUTION FORECASTING
48674, 48682, 48684, 48693, 49019, 49079, 49129, 49132, 49135, 49148, 49166, 49169, 49177, 49178, 49179, 49180, 49185, 49186, 49188, 49204, 49207, 49230, 49232

AIR QUALITY CRITERIA
48806, 49236, 49261, 49374, 49375, 49376, 49399

AIR QUALITY MEASUREMENT PROGRAMS
48967, 49006, 49042, 49101, 49117, 49119, 49122, 49125, 49126, 49131, 49148, 49173, 49192, 49200, 49230, 49232, 49253, 49254, 49267, 49284, 49292, 49313, 49314, 49331, 49335, 49354, 49378, 49399, 49406, 49407, 49428

AIR QUALITY STANDARDS
48690, 48693, 48913, 49255, 49259, 49261, 49298, 49313, 49362, 49372, 49383, 49384, 49388, 49389, 49392, 49395, 49396, 49399, 49401, 49405, 49415, 49443

AIR RESOURCE MANAGEMENT
48673, 48678, 48700, 49199, 49261, 49361, 49368, 49380, 49399, 49400, 49403, 49408, 49409, 49410, 49412, 49413, 49414, 49415, 49416, 49417, 49418, 49421, 49428, 49431, 49435, 49437

AIR-FUEL RATIO
48686, 48702, 48731, 48740, 48761, 48848, 48871, 48880, 48901, 48926, 48936, 48972

AIRCRAFT
48618, 48628, 48665, 48674, 48822, 48894, 49077, 49139, 49159, 49203, 49205, 49404

AIRPORTS
48674, 49129, 49394

ALABAMA
49432

ALASKA
49210

ALCOHOLS
48683, 48701, 48746, 48752, 48831, 48928, 49015, 49017, 49048, 49261, 49324

ALDEHYDES
48665, 48673, 48759, 48831, 48955, 48957, 49221, 49261, 49283, 49293, 49324

ALERTS
49097, 49192, 49285

ALFALFA
49151

ALKALINE ADDITIVES
48625, 48694, 48708, 48736, 48742, 48743, 48745, 48795, 48796, 48807, 48832, 48836, 48847, 48852, 48862, 48876, 48887, 48896, 48912, 48939

ALLERGIES
49283

ALUMINUM
48897, 48974

ALUMINUM COMPOUNDS
48642, 48890, 49061, 49114, 49115, 49195, 49312

ALVEOLI
49242, 49322

AMINES
48710, 48980, 49094, 49260

AMINO ACIDS
49244, 49251, 49334

AMMONIA
48626, 48651, 48709, 48710, 48796, 48805, 48902, 48911, 48923, 48930, 48958, 48994, 49086, 49147, 49335, 49346

AMMONIUM COMPOUNDS
48626, 48651, 48709, 48710, 48796, 48805, 48902, 48911, 48923, 48930, 48958, 48994, 49086, 49111, 49147, 49182, 49209, 49335, 49346

ANIMALS (NON-HUMAN)
48636, 48651, 48659, 48661, 49241, 49242, 49244, 49249, 49250, 49258, 49263, 49266, 49275, 49279, 49280, 49281, 49282, 49289, 49293, 49295, 49296, 49297, 49298, 49302, 49303, 49307, 49309, 49311, 49314, 49315, 49316, 49317, 49318, 49324, 49325, 49326, 49327, 49330, 49337

ANTHRACOSIS
49307

ANTIMONY COMPOUNDS
48619, 48637, 48655, 48669, 49195

AREA SURVEYS
49006, 49042, 49101, 49117, 49119, 49122, 49125, 49126, 49131, 49148, 49173, 49192, 49200, 49230, 49232, 49253, 49254, 49267, 49284, 49292, 49313, 49314, 49331, 49335, 49354, 49428

ARIZONA
49412

AROMATIC FRACTIONS
49091

AROMATIC HYDROCARBONS
48650, 48752, 48831, 48947, 48996, 49015, 49038, 49119, 49218, 49280, 49312

ARSENIC COMPOUNDS
48619, 48637, 48655, 48913, 49001, 49016, 49034, 49140, 49195, 49268

ARSINE
49140

ASBESTOS
48634, 48964, 49248, 49255, 49271

ASBESTOSIS
48634, 49248, 49271

ASHES
48985

ASTHMA
49254, 49265, 49266, 49283, 49287, 49288, 49290, 49291, 49299, 49314

ATMOSPHERIC MOVEMENTS
48646, 48948, 49118, 49132, 49135, 49141, 49148, 49150, 49152, 49153, 49154, 49156, 49160, 49163, 49165, 49166, 49167, 49168, 49169, 49174, 49180, 49186, 49187, 49192, 49193, 49194, 49195, 49200, 49204, 49206, 49207, 49211, 49259, 49406

AUSTRALASIA
49120, 49193

AUSTRALIA
49120, 49193

AUTOMATIC MEASUREMENT METHODS
48947, 48952, 48965, 49007, 49010, 49021, 49058, 49068, 49079

AUTOMOBILES
48628, 48630, 48693, 48759, 48768, 48801, 48825, 48855, 48888, 48894, 48901, 48917, 48925, 48941, 48973, 49043, 49066, 49127, 49282

AUTOMOTIVE EMISSION CONTROL
48618, 48628, 48635, 48674, 48683, 48686, 48693, 48702, 48706, 48722, 48727, 48731, 48740, 48746, 48753, 48757, 48759, 48761, 48763, 48768, 48769, 48773, 48777, 48782, 48787, 48797, 48801, 48809, 48815, 48820, 48821, 48826, 48833, 48835, 48837, 48848, 48849, 48850, 48851, 48854, 48855, 48865, 48870, 48871, 48877, 48878, 48879, 48880, 48888, 48894, 48898, 48899, 48901, 48903, 48917, 48918, 48925, 48926, 48929, 48935, 48936, 48941, 48942, 48972, 49261, 49364, 49429, 49438

B

BACTERIA
48928, 49241, 49309, 49329

BAFFLES
48774, 48867

BAG FILTERS
48622, 48657, 48843, 48858, 48923, 48932, 48937, 49045

BALLOONS
49077, 49171, 49176, 49201, 49202

BARIUM COMPOUNDS
49243, 49317

BASIC OXYGEN FURNACES
48897

BELGIUM
48619, 49131

BENZENE-SOLUBLE ORGANIC MATTER
48700, 49091, 49095

BENZENES
48752, 48947, 49218

BENZO(3-4)PYRENE
48683, 49101, 49295, 49296, 49307

BENZOPYRENES
48683, 49041, 49101, 49255, 49295, 49296, 49303, 49307

BERYLLIUM COMPOUNDS
48655, 49034, 49061

BESSEMER CONVERTERS
48760

BETA PARTICLES
48971

BIOCHEMISTRY
49244, 49251, 49258, 49281, 49309, 49315, 49334

BIOCLIMATOLOGY
49374

BIOLOGICAL FACTORS
49244, 49251, 49258, 49281, 49309, 49315, 49334

BIOPSY
49248

BLAST FURNACE AND BASIC STEEL PRODUCTS M
48718, 48760, 48924, 48938, 49375

BLOOD CELLS
49244, 49251, 49280, 49289, 49320, 49325

BLOOD CHEMISTRY
48690, 49251, 49260, 49314, 49320, 49325

BODIES OF WATER
48685, 49113, 49128, 49147, 49186, 49195, 49344

BODY FLUIDS
49064

BOILERS
48623, 48629, 48647, 48663, 48675, 48720, 48736, 48825, 48828, 48836, 48842, 48852, 48883, 48884, 48895, 48897, 48915, 48930, 49370

BONES
49306

BREATHING
49271, 49322

BROMIDES
49094

BROMINE
48619, 49202

BROMINE COMPOUNDS
49094

BRONCHI
49283, 49303, 49326

BRONCHIAL CANCER
49271, 49295

BRONCHITIS
49254, 49265, 49268, 49287, 49288, 49290, 49291, 49314, 49328

BRONCHOCONSTRICTION
49283

BROWNIAN MOTION
48719

BUILDINGS
48645, 48697, 48928, 49099

BURNING
49409

BUSES
48628, 48936, 49438

BUTANES
49240

BY-PRODUCT RECOVERY
48652, 48672, 48695, 48707, 48711, 48717, 48739, 48742, 48755, 48767, 48785, 48791, 48805, 48814, 48836, 48838, 48840, 48844, 48847, 48856, 48868, 48890, 48891, 48902, 48909, 48910, 48911, 48912, 48920, 48921, 48931, 48934, 49408

C

CADMIUM COMPOUNDS
48647, 48649, 48655, 49034, 49217, 49255, 49310, 49345, 49433

CALCIUM COMPOUNDS
48639, 48642, 49112, 49114, 49115, 49182

CALIBRATION METHODS
48963, 48970, 48990, 48991, 49010, 49031, 49058, 49074, 49076, 49215, 49226, 49373

CALIFORNIA
48687, 48693, 49128, 49130, 49173, 49348, 49352, 49383, 49391

CANADA
48630, 48632, 48690, 48745, 48859, 48943, 48949, 49016, 49076, 49077, 49088, 49092, 49231, 49344, 49349, 49400

CANCER
48634, 49264, 49268, 49271, 49275, 49278, 49284, 49294, 49295, 49296, 49303, 49307, 49327

CARBON
48710, 48712, 48738, 48778, 48793, 48858, 49043, 49238, 49307

CARBON BLACK
48778, 48793, 48858, 49043, 49238, 49307

CARBON DIOXIDE
48639, 48652, 48660, 48720, 48871, 48923, 49007, 49086, 49089, 49090, 49109, 49133, 49147, 49210, 49221

CARBON DISULFIDE
48909, 48963

CARBON MONOXIDE
48618, 48628, 48630, 48638, 48639, 48643, 48646, 48660, 48665, 48673, 48674, 48682, 48687, 48693, 48700, 48720, 48731, 48746, 48757, 48768, 48769, 48772, 48777, 48804, 48805, 48809, 48819, 48825, 48827, 48830, 48851, 48858, 48871, 48881, 48888, 48894, 48898, 48905, 48911, 48913, 48917, 48918, 48920, 48923, 48926, 48929, 48930, 48934, 48936, 48941, 48945, 49002, 49007, 49043, 49046, 49047, 49048, 49050, 49058, 49066, 49067, 49079, 49086, 49089, 49090, 49099, 49102, 49103, 49127, 49129, 49144, 49147, 49156, 49157, 49166, 49255, 49261, 49275, 49292, 49304, 49305, 49367, 49428, 49429

CARBON TETRACHLORIDE
49042, 49113, 49117, 49162

CARBONATES
48796

CARBOXYHEMOGLOBIN
49250

CARBURETION
48722, 48731, 48782, 48878, 48879, 48880, 48901, 48941

CARCINOGENS
48640, 49255, 49258, 49275, 49295, 49296, 49303, 49307, 49309

CASCADE IMPACTORS
48951, 48982, 48989, 49003, 49049

CATALYSIS
48709, 48723, 48724, 48725, 48727, 48728, 48749, 48757, 48758, 48759, 48762, 48768, 48769, 48772, 48787, 48818, 48827, 48851, 48873, 48874, 48888, 48893, 48898, 48905, 48916, 48917, 48931, 48940, 48941, 48942, 48953, 49139, 49172

CATALYSTS
48709, 48723, 48724, 48725, 48728, 48749, 48757, 48758, 48759, 48762, 48768, 48769, 48772, 48787, 48818, 48827, 48851, 48873, 48874, 48888, 48898, 48905, 48916, 48917, 48931, 48940, 48941, 48942

CATALYTIC ACTIVITY
48709, 48727, 48728, 48749, 48762, 48787, 48818, 48827, 48851, 48873, 48898, 48940, 48953, 49139, 49172

CATALYTIC AFTERBURNERS
48714, 48727, 48757, 48758, 48759, 48762, 48763, 48768, 48769, 48771, 48787, 48877, 48898, 48899, 48905, 48909, 48917, 48923, 48925, 48929, 48935, 48940, 48941, 48942, 49261, 49364

CATALYTIC OXIDATION
48709, 48711, 48714, 48727, 48757, 48758, 48759, 48768, 48769, 48772, 48787, 48796, 48847, 48851, 48873, 48893, 48898, 48899, 48905, 48909, 48912, 48931, 48941

CATTLE
48636, 48659

CELL GROWTH
49242, 49249, 49284, 49289, 49298, 49305, 49330

CELL METABOLISM
49242, 49244, 49249, 49281, 49297, 49298, 49320, 49327, 49329, 49332, 49334, 49341

CELLS (BIOLOGY)
48690, 49241, 49242, 49244, 49251, 49266, 49280, 49281, 49289, 49293, 49303, 49320, 49325, 49326, 49327

CEMENTS
48621, 48622

CENTRIFUGAL SEPARATORS
48622, 48626, 48640, 48671, 48744, 48793, 48801, 48802, 48806, 48843, 48882, 48909, 48911, 48922, 48923, 48934, 48937, 49009, 49045, 49080

CERAMICS
48741

CERIUM COMPOUNDS
48619, 49317

CESIUM COMPOUNDS
49024

CHARCOAL
48710, 48712, 48738

CHEMICAL BONDS
48868

CHEMICAL COMPOSITION
48619, 48623, 48629, 48637, 48642, 48649, 48654, 48655, 48671, 48677, 48679, 48680, 48693, 48700, 48730, 48806, 48890, 48968, 48983, 49001, 49006, 49021, 49026, 49041, 49091, 49095, 49096, 49101, 49110, 49112, 49114, 49115, 49116, 49130, 49140, 49155, 49163, 49209, 49216, 49243

CHEMICAL METHODS
48679, 48805, 48955, 48958, 48969, 48972, 49012, 49047, 49048, 49069, 49073, 49079, 49286, 49376

CHEMICAL PROCESSES
48739, 48752, 48858, 48906, 48909, 48923, 48943

CHEMICALS AND ALLIED MANUFACTURING
48876, 48906, 48923, 48930, 48953, 49100, 49349

CHIBA PREFECTURE
49186, 49230

CHLORIDES
49162, 49163, 49182, 49201, 49202

CHLORINATED HYDROCARBONS
48671, 49039, 49042, 49113, 49117, 49138, 49157, 49162, 49195, 49312

CHLORINE
48619, 48667, 48745, 48875, 48909, 49114, 49115, 49201, 49346, 49347

CHLORINE COMPOUNDS
49125, 49140, 49162, 49163, 49182, 49201, 49202

CHLOROFORM
49042, 49117

CHLOROPLASTS
49332, 49341

CHROMATOGRAPHY
48641, 48653, 48947, 48949, 48956, 48963, 48965, 48980, 48993, 48996, 48998, 49006, 49013, 49015, 49029, 49037, 49038, 49039, 49041, 49042, 49058, 49061, 49064, 49091, 49119, 49130, 49222

CHROMIUM
48827

CHROMIUM COMPOUNDS
48649, 48655, 48953, 49034, 49036, 49061, 49110, 49195, 49243, 49310

CILIA
49242, 49293, 49326

CIRCULATORY SYSTEM
49314

CITRUS
49100

CLAY
48750

CLEAN AIR ACT
49261, 49362, 49372, 49391, 49418

CLOUDS
49022, 49098, 49133, 49146, 49164, 49208, 49213

CLOVER
49331

COAL
48629, 48642, 48680, 48689, 48695, 48700, 48703, 48720, 48726, 48733, 48736, 48779, 48797, 48836, 48842, 48890, 48904, 48908, 48912, 48914, 48920, 48924, 48939, 48944, 48954, 48968, 49199, 49354, 49370, 49401

COAL CONVERSION
48734, 48779, 48793, 48839, 48897, 48908, 48909, 48920, 48933, 48944

COAL PREPARATION
48703, 48726, 48730, 48733, 48735, 48756, 48779, 48856, 48904, 48932

COATING, ENGRAVING AND ALLIED SERVICES
48953

COBALT COMPOUNDS
49195

COKE
48677, 48804, 48856, 48902, 49091

COLLECTORS (MECHANICAL)
48622, 48626, 48640, 48648, 48655, 48671, 48689, 48713, 48744, 48752, 48774, 48785, 48793, 48801, 48802, 48806, 48810, 48816, 48833, 48843, 48845, 48867, 48882, 48900, 48909, 48911, 48922, 48923, 48930, 48932, 48934, 48937, 48938, 49009, 49045, 49073, 49080, 49439, 49440

COLORIMETRY
48956, 48962, 48976, 48979, 48981, 49002, 49037, 49046, 49053, 49068, 49376

COLUMN CHROMATOGRAPHY
49013, 49039, 49091

COMBUSTION
48619, 48638, 48660, 48681, 48686, 48688, 48776, 48797, 48815, 48830, 48858, 48871, 48883, 48891, 48902, 48909, 48918, 48930, 48932, 48934, 49225, 49235, 49238

COMBUSTION AIR
48650, 48660, 48691, 48720, 48740, 48797, 48844, 48869, 48895, 48920

COMBUSTION PRODUCTS
48660, 48672, 48685, 48686, 48776, 48785, 48794, 48797, 48844, 48867, 48907, 48985, 49006, 49072, 49086, 49133, 49215, 49235, 49238, 49250

COMMERCIAL EQUIPMENT
48842, 49077, 49359, 49441

COMMERCIAL FIRMS
48808, 49359, 49411

COMMON COLD
49313

COMPLAINTS
48670, 48678, 49127, 49419, 49426, 49432

COMPLIANCE (RESPIRATORY)
49381, 49382, 49383, 49384, 49385, 49386, 49387, 49389, 49392, 49393, 49395, 49396, 49397, 49405, 49410, 49412, 49413, 49414, 49416

COMPRESSION
48923, 48926

COMPUTER PROGRAMS
48682, 48994, 49011, 49056, 49156, 49181, 49212, 49234, 49277, 49401

COMPUTERS
48994, 49011, 49056, 49215, 49277

CONDENSATION
48627, 48695, 48788, 48789, 48813, 48833, 48861, 48902, 48909, 48923, 49217

CONDENSATION (ATMOSPHERIC)
49022, 49098, 49133, 49146, 49164, 49170, 49197, 49208, 49213

CONDUCTIMETRIC METHODS
49054

CONING
48631

CONNECTICUT
49390

CONSTRUCTION MATERIALS
48621, 48622, 48624, 48741, 48814, 48890, 48921, 49439

CONTACT PROCESS
48906

CONTINUOUS MONITORING
48962, 49021, 49067, 49079, 49085

CONTRACTING
49423

CONTROL AGENCIES
48678, 49369, 49400, 49402, 49427, 49428

CONTROL EQUIPMENT-GAS STREAMS
48622, 48625, 48626, 48639, 48640, 48648, 48655, 48657, 48671, 48680, 48689, 48691, 48694, 48696, 48697, 48698, 48704, 48705, 48710, 48713, 48714, 48715, 48716, 48719, 48721, 48727, 48729, 48732, 48735, 48736, 48737, 48741, 48743, 48744, 48745, 48751, 48752, 48754, 48757, 48758, 48759, 48760, 48762, 48763, 48764, 48765, 48766, 48768, 48769, 48771, 48774, 48778, 48783, 48784, 48785, 48787, 48790, 48792, 48793, 48795, 48796, 48798, 48799, 48800, 48801, 48802, 48803, 48805, 48806, 48807, 48810, 48812, 48813, 48816, 48819, 48820, 48823, 48829, 48832, 48833, 48834, 48836, 48841, 48842, 48843, 48845, 48846, 48847, 48852, 48853, 48857, 48858, 48859, 48860, 48861, 48862, 48867, 48869, 48875, 48876, 48877, 48882, 48887, 48889, 48891, 48892, 48895, 48896, 48897, 48898, 48899, 48900, 48902, 48905, 48906, 48907, 48909, 48911, 48912, 48913, 48914, 48915, 48916, 48917, 48919, 48922, 48923, 48924, 48925, 48929, 48930, 48932, 48934, 48935, 48936, 48937, 48938, 48939, 48940, 48941, 48942, 48945, 48946, 48958, 48961, 49009, 49010, 49021, 49039, 49040, 49045, 49073, 49080, 49238, 49261, 49359, 49360, 49364, 49398, 49401, 49423, 49439, 49440

CONTROL PROGRAMS
48673, 48693, 48700, 48796, 48804, 48808, 48929, 49123, 49199, 49255, 49257, 49294, 49363, 49365, 49378, 49379, 49388, 49400, 49402, 49403, 49406, 49407, 49410, 49415, 49416, 49418, 49419, 49426, 49429, 49432, 49435, 49441

COOLING
48622, 48785, 48853, 48891, 48909, 48923

COOLING TOWERS
48876, 49212, 49377

COPPER
48750, 48827

COPPER ALLOYS
48750

COPPER COMPOUNDS
48649, 49110, 49112, 49195, 49331, 49345

CORN
49241

CORROSION
48833, 49121, 49357, 49358

COSTS
48673, 48694, 48695, 48696, 48699, 48711, 48713, 48715, 48736, 48742, 48744, 48755, 48784, 48796, 48808, 48813, 48828, 48856, 48858, 48859, 48862, 48908, 48910, 48925, 48933, 48935, 48937, 48944, 48945, 49047, 49335, 49360, 49361, 49362, 49363, 49364, 49365, 49366, 49367, 49401, 49402, 49408, 49421, 49427

COTTON GINNING
48626

COUGH
49269

COUNTY GOVERNMENTS
49432

CRANKCASE EMISSIONS
48929

CRITERIA
48624, 48806, 48913, 49034, 49224, 49236, 49261, 49286, 49298, 49369, 49370, 49373, 49374, 49375, 49376, 49391, 49399, 49415, 49443

CROP SERVICES
48626

CROPS
48636, 49151, 49241, 49331, 49334, 49340, 49348, 49352

CUMULATIVE MEASUREMENT METHODS
49035

CUPOLAS
48924, 49088

CYANIDES
48626, 48864, 48958, 49058

CYCLIC CRUDES AND INTERMEDIATE PRODUCTIO
48953

CZECHOSLOVAKIA
48954, 49051, 49084, 49180

D

DATA ANALYSIS
49011, 49079, 49181, 49277

DATA HANDLING SYSTEMS
48682, 48870, 48948, 48994, 49011, 49056, 49079, 49156, 49181, 49212, 49215, 49234, 49277, 49399, 49401, 49420

DECISIONS
49418

DECOMPOSITION
48738, 49162

DEPOSITION
48680, 48890, 49080, 49151, 49158, 49196, 49200, 49239, 49317, 49318, 49322, 49331, 49336

DIAGNOSIS
49248, 49262, 49265, 49268, 49287, 49305

DIESEL ENGINES
48620, 48628, 48635, 48643, 48644, 48777, 48822, 48835, 48877, 48918, 48929, 48936, 49043, 49225, 49235, 49438

DIFFUSION (ATMOSPHERIC)
48627, 48631, 48667, 48682, 48719, 48764, 49019, 49118, 49129, 49135, 49136, 49137, 49138, 49141, 49142, 49144, 49147, 49149, 49150, 49153, 49154, 49156, 49157, 49158, 49159, 49162, 49166, 49167, 49168, 49170, 49173, 49174, 49175, 49176, 49177, 49181, 49183, 49184, 49185, 49186, 49187, 49191, 49192, 49194, 49199, 49200, 49202, 49204, 49206, 49207, 49208, 49211, 49212, 49219, 49239, 49259, 49292, 49331, 49337, 49442

DIFFUSION MODELS
48682, 49019, 49129, 49135, 49137, 49141, 49144, 49147, 49149, 49150, 49154, 49156, 49159, 49162, 49166, 49168, 49174, 49175, 49177, 49181, 49183, 49184, 49185, 49186, 49191, 49194, 49200, 49204, 49206, 49207, 49208, 49211, 49212, 49259

DIGESTIVE SYSTEM
49258, 49268, 49309, 49326

DIGITAL METHODS
48955, 48990, 49011, 49215

DISPERSIONS
48797

DISPLACEMENT
48959

DISSOCIATION
49138, 49161, 49162

DISTILLATE OILS
48822, 48944, 49220

DOGS
49279, 49316, 49317

DOMESTIC HEATING
48645, 48650, 48664, 48772, 48895, 48913, 49099, 49110, 49122, 49123, 49408, 49428

DROPLETS
48812, 48985, 49022, 49208

DRYING
48651, 49400

DUMPS
48634

DUST FALL
48983, 49024, 49110, 49126, 49158, 49182, 49243, 49435

DUSTS
48636, 48637, 48638, 48640, 48648, 48649, 48654, 48657, 48663, 48669, 48671, 48676, 48689, 48697, 48715, 48732, 48744, 48755, 48760, 48767, 48785, 48806, 48807, 48808, 48810, 48819, 48859, 48875, 48891, 48900, 48906, 48919, 48922, 48923, 48924, 48930, 48937, 48946, 48950, 48954, 48968, 48982, 48983, 48990, 48991, 48992, 49004, 49009, 49010, 49016, 49026, 49036, 49051, 49082, 49085, 49095, 49103, 49110, 49112, 49133, 49141, 49155, 49157, 49158, 49198, 49224, 49243, 49263, 49271, 49283, 49294, 49326, 49424, 49428

DYE MANUFACTURING
48953

DYNAMOMETERS
48917, 48926

E

ECONOMIC LOSSES
49335, 49366, 49421

ECONOMICS
48673, 48694, 48695, 48696, 48699, 48711, 48713, 48715, 48736, 48742, 48744, 48755, 48784, 48796, 48808, 48813, 48828, 48856, 48858, 48859, 48862, 48908, 48910, 48925, 48933, 48935, 48937, 48944, 48945, 49047, 49335, 49360, 49361, 49362, 49363, 49364, 49365, 49366, 49367, 49401, 49402, 49408, 49421, 49427

EFFICIENCY
48618, 48640, 48657, 48672, 48677, 48679, 48689, 48695, 48696, 48700, 48709, 48710, 48711, 48718, 48719, 48722, 48732, 48736, 48737, 48738, 48739, 48741, 48742, 48743, 48744, 48748, 48749, 48754, 48755, 48756, 48758, 48762, 48764, 48768, 48779, 48782, 48783, 48792, 48793, 48795, 48798, 48799, 48800, 48801, 48803, 48807, 48818, 48819, 48827, 48829, 48832, 48840, 48841, 48842, 48846, 48847, 48848, 48851, 48852, 48858, 48859, 48861, 48862, 48865, 48873, 48875, 48897, 48908, 48914, 48915, 48916, 48917, 48918, 48919, 48931, 48932, 48937, 48939, 48942, 48945, 48953, 48955, 48957, 48963, 48965, 48972, 48974, 48981, 48987, 48989, 48992, 48999, 49001, 49002, 49005, 49012, 49016, 49026, 49027, 49032, 49033, 49039, 49046, 49053, 49061, 49063, 49066, 49072, 49076, 49086, 49088, 49092, 49208, 49233, 49234, 49423

ELECTRIC FURNACES
48648, 48649, 48924

ELECTRIC POWER GENERATION
48642, 48672, 48673, 48680, 48684, 48689, 48691, 48700, 48707, 48742, 48754, 48783,

48795, 48796, 48807, 48825, 48828, 48829, 48832, 48836, 48842, 48852, 48862, 48890, 48896, 48897, 48912, 48913, 48914, 48915, 48924, 48932, 48938, 48939, 49110, 49137, 49167, 49199, 49354, 49362, 49370, 49375, 49377, 49398, 49401, 49406, 49422, 49442

ELECTRIC POWER SOURCES
49369

ELECTRIC, GAS, AND SANITARY SERVICES
48625, 48626, 48633, 48634, 48640, 48642, 48651, 48652, 48660, 48662, 48666, 48668, 48670, 48671, 48672, 48673, 48680, 48684, 48685, 48688, 48689, 48691, 48694, 48699, 48700, 48707, 48710, 48713, 48714, 48716, 48742, 48748, 48752, 48754, 48765, 48767, 48783, 48791, 48795, 48796, 48807, 48813, 48814, 48817, 48823, 48825, 48828, 48829, 48832, 48836, 48842, 48852, 48860, 48862, 48863, 48875, 48882, 48890, 48896, 48897, 48912, 48913, 48914, 48915, 48923, 48924, 48927, 48932, 48938, 48939, 49100, 49110, 49137, 49167, 49199, 49354, 49362, 49370, 49375, 49377, 49398, 49400, 49401, 49406, 49408, 49422, 49426, 49442

ELECTRICAL MEASUREMENT DEVICES
49083

ELECTRICAL PROPERTIES
48737, 48754, 48783, 48803, 48812, 48846, 48857, 48889, 48897, 48915, 48919, 48969, 49216, 49224, 49227, 49238, 49332

ELECTRICAL RESISTANCE
48737, 48754, 48915, 48969, 49216

ELECTRICITY (ATMOSPHERIC)
49170

ELECTROCHEMICAL METHODS
48805, 48955, 48969, 48972, 49012, 49047, 49048, 49069, 49073, 49079, 49286

ELECTROLYSIS
48780

ELECTRON MICROSCOPY
49248, 49296

ELECTROSTATIC PRECIPITATORS
48622, 48640, 48657, 48671, 48680, 48689, 48694, 48704, 48737, 48744, 48754, 48783, 48790, 48793, 48803, 48806, 48812, 48829, 48846, 48857, 48875, 48882, 48897, 48911, 48913, 48914, 48915, 48919, 48922, 48923, 48924, 48932, 48937, 48938, 49238

EMISSION INVENTORIES
48675, 48678, 48687, 49200, 49399

EMISSION STANDARDS
48620, 48684, 48690, 48768, 48925, 48929, 48935, 48941, 49255, 49362, 49370, 49374, 49375, 49381, 49382, 49385, 49393, 49397, 49398, 49407, 49415, 49422, 49424, 49425, 49429

EMPHYSEMA
49314

EMULSIONS
48797

ENCAPSULATION
48824

ENFORCEMENT PROCEDURES
48678, 49379, 49401, 49402, 49408, 49428, 49432

ENGINE DESIGN MODIFICATION
48618, 48628, 48674, 48706, 48731, 48740, 48759, 48761, 48837, 48848, 48865, 48877, 48894, 48926, 48936

ENGINE EMISSIONS
48618, 48620, 48630, 48643, 48644, 48656, 48658, 48665, 48667, 48674, 48682, 48683, 48693, 48702, 48706, 48717, 48721, 48722, 48727, 48729, 48731, 48740, 48746, 48751, 48753, 48757, 48758, 48759, 48761, 48763, 48768, 48769, 48771, 48777, 48782, 48787, 48801, 48802, 48809, 48820, 48822, 48825, 48826, 48833, 48835, 48837, 48848, 48850, 48855, 48865, 48867, 48870, 48877, 48878, 48880, 48888, 48892, 48894, 48898, 48899, 48901, 48905, 48917, 48926, 48929, 48935, 48936, 48941, 48955, 48957, 48960, 48972, 48978, 49043, 49048, 49066, 49110, 49124, 49127, 49139, 49159, 49181, 49205, 49207, 49220, 49247, 49259, 49279, 49282, 49302, 49364, 49367, 49398, 49404, 49428, 49438

ENGINE OPERATING CYCLES
48620, 48630, 48643, 48644, 48665, 48693, 48702, 48727, 48771, 48809, 48815, 48821, 48826, 48850, 48855, 48878, 48926, 48941

ENGINE OPERATION MODIFICATION
48674, 48683, 48686, 48702, 48722, 48727, 48731, 48740, 48761, 48782, 48797, 48821, 48833, 48835, 48848, 48849, 48850, 48854, 48870, 48871, 48878, 48879, 48880, 48894, 48901, 48903, 48918, 48926, 48936, 48941, 48972, 49438

ENGINES
48618, 48620, 48628, 48635, 48643, 48644, 48665, 48702, 48706, 48717, 48727, 48729, 48731, 48740, 48753, 48757, 48761, 48769, 48771, 48777, 48782, 48787, 48802, 48809, 48815, 48820, 48821, 48822, 48835, 48837, 48848, 48854, 48870, 48877, 48880, 48894, 48898, 48899, 48905, 48918, 48929, 48936, 48960, 49043, 49225, 49235, 49438

ENZYMES
49258, 49309, 49320, 49329, 49330, 49334

EPIDEMIOLOGY
48967, 49247, 49252, 49253, 49254, 49255, 49256, 49257, 49278, 49288, 49290, 49294, 49305

EPITHELIUM
49293, 49295, 49296, 49303

EQUIPMENT STANDARDS
48620

ESTERS
49013, 49015, 49249

ETHYLENE
48831, 49038, 49335, 49343

EUROPE
48619, 48620, 48621, 48622, 48624, 48627, 48639, 48640, 48650, 48652, 48668, 48678, 48689, 48693, 48694, 48697, 48698, 48701, 48704, 48709, 48718, 48731, 48739, 48744, 48751, 48752, 48760, 48763, 48767, 48774, 48776, 48781, 48783, 48792, 48793, 48797, 48798, 48799, 48800, 48803, 48804, 48806, 48810, 48827, 48830, 48839, 48868, 48890, 48891, 48893, 48894, 48902, 48906, 48913, 48948, 48950, 48954, 48961, 48964, 48978, 48979, 48987, 49002, 49019, 49020, 49046, 49050, 49051, 49055, 49056, 49057, 49061, 49065, 49084, 49093, 49095, 49113, 49131, 49134, 49137, 49141, 49145, 49149, 49155, 49157, 49158, 49163, 49170, 49180, 49196, 49197, 49200, 49201, 49202, 49211, 49213, 49217, 49222, 49236, 49238, 49241, 49242, 49258, 49260, 49263, 49271, 49272, 49294, 49295, 49296, 49297, 49298, 49306, 49310, 49318, 49323, 49324, 49325, 49327, 49328, 49329, 49330, 49334, 49351, 49353, 49355, 49356, 49357, 49371, 49375, 49377, 49398, 49403, 49407, 49420, 49422, 49424, 49428, 49430, 49439, 49442, 49443

EXCESS AIR
48650, 48691, 48720, 48740, 48844, 48895

EXCRETIONS
48661, 49251, 49260, 49268, 49286, 49319

EXHAUST SYSTEMS
48639, 48697, 48751, 48806, 48843, 48900, 48922, 49439

EXPERIMENTAL EQUIPMENT
48859, 48919, 49011, 49066, 49080, 49090, 49215, 49235

EXPERIMENTAL METHODS
48700, 48719, 48758, 48797, 48812, 48931, 48957, 49017, 49066, 49080, 49083, 49219, 49234, 49235, 49275, 49308, 49352, 49415

EXPLOSIONS
48886, 48968, 49094

EXPOSURE CHAMBERS
49215, 49275

EXPOSURE METHODS
49215, 49242, 49245, 49275, 49279, 49281, 49303, 49307, 49311, 49318, 49324, 49326, 49328, 49333, 49338, 49341, 49352, 49358

EYE IRRITATION
49268, 49274

F

FABRIC FILTERS
48622, 48657, 48843, 48858, 48923, 48932, 48937, 49045

FALLOUT
49024

FANS (BLOWERS)
48900

FARMS
48627, 48651, 48661, 48670, 48791, 48927, 49344, 49400

FAT AND OIL PRODUCTION
48626, 48813

FEEDLOTS
48626, 48659, 48668, 48670, 48692, 48791, 48927, 49400

FEES
49363

FERROALLOYS
48851, 48924

FIELD TESTS
48711, 48736, 48783, 48795, 48803, 48807, 48829, 48852, 48862, 48896, 48973, 48974, 49026, 49088, 49149, 49239

FILTER FABRICS
48626, 48640, 48698, 48715, 48732, 48741, 48792, 48793, 48800, 48834, 48923, 48937, 48938, 48946, 49039, 49040

FILTERS
48622, 48626, 48640, 48657, 48697, 48698, 48715, 48732, 48735, 48741, 48744, 48774, 48792, 48793, 48800, 48802, 48806, 48819, 48820, 48834, 48843, 48845, 48857, 48858, 48882, 48891, 48909, 48913, 48916, 48922, 48923, 48932, 48937, 48938, 48946, 48958, 48961, 49010, 49021, 49039, 49040, 49045, 49439

FINLAND
49271

FIRING METHODS
48638, 48650, 48660, 48662, 48664, 48665, 48686, 48688, 48691, 48720, 48722, 48740, 48770, 48776, 48782, 48797, 48817, 48830, 48844, 48869, 48871, 48872, 48881, 48883,

48884, 48894, 48895, 48909, 48911, 48920, 48922, 48925, 48932, 48933, 49225

FLAME AFTERBURNERS
48729, 48751, 48765, 48778, 48909, 48925, 48935, 48941, 48945

FLAME IONIZATION DETECTOR (CO)
48993, 49006, 49015, 49042, 49119

FLAMES
48930, 48934

FLARES
48784, 48869, 48907

FLOWERS
49338, 49349

FLOWMETERS
49066, 49074

FLUID FLOW
48686, 48697, 48712, 48764, 48783, 48800, 48846, 48960, 49016, 49153, 49207, 49208, 49211, 49239

FLUORESCENCE
49078, 49241

FLUORIDES
48626, 48636, 48639, 48806, 48923, 49068, 49069, 49072, 49073, 49096, 49100, 49151, 49219, 49255, 49340, 49349, 49354

FLUORINATED HYDROCARBONS
48990, 49231

FLUORINE
49126, 49340

FLUORINE COMPOUNDS
48626, 48636, 48639, 48806, 48868, 48923, 49068, 49069, 49072, 49073, 49096, 49100, 49116, 49151, 49219, 49255, 49286, 49340, 49345, 49349, 49350, 49354

FLUOROSIS
48636

FLY ASH
48619, 48642, 48655, 48680, 48690, 48700, 48711, 48737, 48754, 48795, 48814, 48860, 48890, 48915, 48921, 49004, 49017, 49216, 49229, 49354

FOG
49022

FOOD AND KINDRED PRODUCTS INDUSTRY
48626, 48659, 48745, 48813

FORESTS
48627, 49182, 49409

FORMALDEHYDES
48831, 49283, 49293, 49324

FORMIC ACID
48796, 49094

FRACTIONATION
48920

FRANCE
48652, 48689, 48797, 48810, 48891, 48987, 49201, 49202, 49211, 49236, 49407

FREE RADICALS
49172, 49189

FROTH FLOATATION
48733, 48756

FRUITS
49100

FUEL ADDITIVES
48686, 48746, 48775, 48777, 48822, 48929, 48936, 49259

FUEL CHARACTERISTICS
48619, 48677, 48679, 48730, 48754, 48756, 48832, 48921, 48933

FUEL CHARGING
48722, 48782, 48894

FUEL EVAPORATION
48656, 48721, 48892, 48929, 49220

FUEL GASES
48638, 48645, 48689, 48720, 48902, 48908, 48944

FUEL OIL PREPARATION
48650, 48723, 48724, 48725, 48728, 48786, 48811, 48828, 48874, 48882, 48934, 48944

FUEL OILS
48629, 48638, 48645, 48650, 48681, 48689, 48703, 48720, 48724, 48725, 48726, 48728, 48786, 48793, 48797, 48804, 48811, 48822, 48828, 48874, 48910, 48944, 49064, 49137, 49220

FUEL RESOURCES
48756

FUEL STANDARDS
49424

FUEL TANK EVAPORATION
48656, 48892, 49220

FUEL TREATMENT
48650, 48703, 48723, 48724, 48725, 48726, 48728, 48730, 48733, 48734, 48735, 48756, 48779, 48786, 48793, 48796, 48811, 48828, 48839, 48856, 48874, 48882, 48897, 48904, 48908, 48909, 48911, 48920, 48932, 48933, 48934, 48944

FUMES
48750, 48806, 48864, 48922, 48923, 48945, 49424

FUNGI
49356

FURNACES
48618, 48622, 48623, 48637, 48647, 48648, 48649, 48650, 48652, 48654, 48657, 48664, 48770, 48772, 48793, 48799, 48804, 48810, 48844, 48858, 48871, 48872, 48875, 48881, 48883, 48895, 48897, 48924, 48938, 48974, 49036, 49088, 49110, 49371, 49375

G

GAMMA RADIATION
48919

GAS CHROMATOGRAPHY
48641, 48653, 48947, 48949, 48956, 48965, 48980, 48993, 48996, 48998, 49006, 49013, 49015, 49029, 49037, 49038, 49039, 49041, 49042, 49061, 49064, 49091, 49119, 49130, 49222

GAS SAMPLING
48952, 48957, 48965, 48967, 48975, 48998, 49013, 49032, 49039, 49040, 49042, 49057, 49064, 49070, 49071, 49072, 49073, 49074, 49076, 49088, 49219, 49222

GAS TURBINE ENGINES
48618, 48665, 48894, 48960

GASIFICATION
48734, 48779, 48793, 48839, 48897, 48908, 48909, 48920, 48944

GASOLINES
48628, 48683, 48721, 48746, 48771, 48775, 49220, 49259, 49411

GENETICS
49309, 49329, 49338

GEORGIA
49396

GERMANY, FEDERAL REPUBLIC
48620, 48621, 48622, 48639, 48640, 48668, 48701, 48744, 48760, 48763, 48781, 48830, 48839, 48902, 48950, 48979, 49020, 49050, 49093, 49095, 49134, 49141, 49145, 49163, 49170, 49213, 49260, 49263, 49295, 49296, 49310, 49327, 49328, 49334, 49355, 49356, 49357, 49371, 49377, 49403, 49422, 49439, 49443

GLADIOLUS
49349

GLANDS
49311, 49325, 49330

GLASS
48741

GLASS FABRICS
48741, 48793, 49039, 49040

GRAIN PROCESSING
48745

GRANTS
49423, 49424, 49427

GRAPHITE
48741

GRASSES
49151

GRAVITY COLLECTORS
48774, 48806, 48867, 48922, 48923

GREAT BRITAIN
48627, 48678, 48694, 48697, 48806, 48893, 48894, 48964, 48978, 49113, 49217, 49238, 49242, 49271, 49306, 49318, 49351, 49353, 49424, 49428

GROUND LEVEL
48631, 48682, 49135, 49137, 49141, 49142, 49146, 49147, 49156, 49164, 49180, 49181, 49184, 49194, 49199, 49264

GUINEA PIGS
49266, 49293

H

HALOGEN GASES
48619, 48626, 48667, 48684, 48745, 48875, 48909, 48987, 49078, 49114, 49115, 49126, 49201, 49202, 49340, 49346, 49347

HALOGENATED HYDROCARBONS
48626, 48671, 48990, 49039, 49042, 49113, 49117, 49119, 49138, 49157, 49161, 49162, 49172, 49195, 49231, 49264, 49312, 49348

HAMSTERS
49295, 49296, 49303, 49326

HARBORS
48685, 49128, 49186

HAZE
49164, 49170, 49197

HEALTH IMPAIRMENT
48639, 49242, 49249, 49250, 49253, 49255, 49256, 49257, 49267, 49268, 49269, 49270, 49271, 49272, 49274, 49279, 49282, 49284, 49285, 49298, 49299, 49301, 49304, 49314, 49321, 49366, 49376, 49399, 49404, 49419, 49428, 49435, 49441

HEALTH STATISTICS
49273, 49294, 49305, 49415

HEAT TRANSFER
48622, 48700, 48717, 48782, 48785, 48845, 48853, 48867, 48891, 48909, 48923, 49414

HEAVY-DUTY VEHICLES
48628, 48643, 48936, 49438

HEIGHT FINDING
49375, 49424, 49442

HEMATOLOGY
48690, 49244, 49250, 49251, 49260, 49268, 49289, 49297, 49314, 49320, 49325

HEMOGLOBIN
49244, 49289

HERBICIDES
49311

HEXANES
49218

HI-VOL SAMPLERS
48960, 49016, 49026

HIGHWAYS
48643, 48658, 48682, 48814, 48921, 49102, 49118, 49124, 49127, 49142, 49144, 49156, 49207, 49247, 49304, 49337, 49367, 49394

HOGS
48659, 48661

HORMONES
49311, 49325

HUMIDITY
48697, 48961, 49054, 49063, 49134, 49170, 49212, 49213, 49358

HYDRAZINES
48805, 49298

HYDROCHLORIC ACID
48667, 48864, 48875, 49032, 49058, 49147, 49162, 49181, 49346, 49355

HYDRODESULFURIZATION
48723, 48724, 48725, 48728, 48786, 48811, 48934, 48944

HYDROFLUORIC ACID
48864, 48876, 49058, 49335, 49346, 49354

HYDROGEN
48660, 48827, 49221, 49292

HYDROGEN SULFIDE
48666, 48670, 48710, 48738, 48805, 48858, 48902, 48909, 48911, 48934, 48949, 48963, 48969, 49079, 49086, 49157, 49233, 49292

HYDROGENATION
48650, 48726, 48786, 48839

HYDROSPHERE
49140, 49147, 49195

HYDROXIDES
49189, 49240

I

IDAHO
49394, 49417

IMMUNOLOGY
49242, 49269, 49314, 49315

IMPINGEMENT
48952, 49053, 49054, 49073

INCINERATORS (REFUSE)
48626, 48640, 48651, 48652, 48660, 48662, 48671, 48672, 48685, 48688, 48713, 48714, 48752, 48765, 48813, 48817, 48823, 48875, 48897, 48923, 49375

INCINERATORS (WASTE GASES)
48714, 48727, 48729, 48751, 48757, 48758, 48759, 48762, 48763, 48765, 48768, 48769, 48771, 48778, 48787, 48877, 48898, 48899, 48905, 48909, 48911, 48917, 48923, 48925, 48929, 48934, 48935, 48936, 48940, 48941, 48942, 48945, 49261, 49364

INDOOR
48624, 48697, 48819, 48928, 49046, 49099, 49157

INDUSTRIAL AREAS
48752, 49006, 49124, 49126, 49127, 49148, 49158, 49177, 49186, 49200, 49271, 49278, 49331, 49344, 49355

INERTIAL SEPARATION
48719, 48802, 48923

INFECTIOUS DISEASES
49242, 49326

INFLUENZA
49315

INFRARED RADIATION
48676, 49197, 49205

INFRARED SPECTROMETRY
49027, 49028, 49043, 49067, 49089, 49090, 49094, 49197

INGESTION
49249, 49319

INHIBITION
49244, 49249, 49298

INORGANIC ACIDS
48626, 48667, 48768, 48864, 48875, 48876, 48931, 48976, 49032, 49058, 49147, 49162, 49181, 49200, 49261, 49262, 49276, 49335, 49346, 49354, 49355

INSPECTION
48643, 48678, 48758

INSTRUMENTATION
48948, 48949, 48955, 48961, 48963, 48970, 48971, 48977, 48991, 48996, 49008, 49010, 49022, 49026, 49049, 49068, 49070, 49071, 49072, 49073, 49076, 49079, 49080, 49085, 49089, 49193, 49222, 49226, 49235

INTERNAL COMBUSTION ENGINES
48620, 48628, 48635, 48643, 48644, 48702, 48706, 48717, 48727, 48729, 48731, 48740, 48753, 48757, 48761, 48769, 48771, 48777, 48782, 48787, 48802, 48809, 48815, 48820, 48821, 48822, 48835, 48837, 48848, 48854, 48870, 48877, 48880, 48898, 48899, 48905, 48918, 48929, 48936, 48960, 49043, 49225, 49235, 49438

INVERSION
49011, 49157, 49166, 49191, 49193, 49200, 49201, 49202, 49206, 49259

IODIMETRIC METHODS
49079, 49376

IODINATED HYDROCARBONS
49113

IODINE
48619, 49078

IONIZATION
48790, 49238

IONS
49040, 49083, 49110, 49111, 49182, 49227, 49238, 49332

IOWA
49381, 49382

IRELAND
49113, 49271

IRON
48827, 48922, 49357, 49358

IRON COMPOUNDS
48649, 48890, 48951, 49034, 49112, 49115, 49195, 49331, 49345

IRON OXIDES
48623, 48639, 48827, 49318

ISOTOPES
49319, 49327

ITALY
48751, 48776, 48948, 49134, 49137, 49330

J

JAPAN
48623, 48629, 48633, 48635, 48637, 48638, 48641, 48644, 48645, 48647, 48648, 48649, 48651, 48653, 48654, 48656, 48657, 48661, 48662, 48663, 48664, 48666, 48669, 48670, 48671, 48707, 48710, 48738, 48747, 48748, 48749, 48750, 48759, 48761, 48765, 48766, 48770, 48771, 48772, 48773, 48775, 48780, 48786, 48788, 48789, 48790, 48791, 48809, 48815, 48816, 48818, 48819, 48821, 48823, 48825, 48826, 48831, 48833, 48835, 48837, 48838, 48849, 48850, 48851, 48854, 48855, 48863, 48864, 48865, 48870, 48871, 48872, 48873, 48874, 48875, 48876, 48878, 48879, 48880, 48881, 48882, 48883, 48884, 48885, 48886, 48895, 48903, 48905, 48927, 48951, 48952, 48956, 48957, 48958, 48959, 48975, 48976, 48980, 48981, 48982, 48983, 48984, 48988, 48989, 48990, 48991, 48992, 48993, 48995, 48997, 48998, 48999, 49000, 49001, 49003, 49004, 49005, 49006, 49007, 49008, 49009, 49011, 49012, 49013, 49014, 49015, 49021, 49025, 49029, 49030, 49031, 49032, 49033, 49035, 49036, 49037, 49038, 49039, 49040, 49041, 49042, 49043, 49044, 49045, 49052, 49053, 49054, 49058, 49059, 49060, 49062, 49063, 49094, 49096, 49097, 49101, 49102, 49103, 49104, 49105, 49106, 49107, 49108, 49109, 49111, 49112, 49114, 49115, 49116, 49117, 49118, 49119, 49121, 49122, 49123, 49124, 49125, 49126, 49127, 49142, 49143, 49148, 49150, 49152, 49153, 49154, 49157, 49160, 49165, 49166, 49167, 49168, 49169, 49174, 49175, 49176, 49177, 49178, 49179, 49183, 49184, 49185, 49186, 49187, 49188, 49190, 49191, 49192, 49220, 49223, 49225, 49227, 49228, 49229, 49230, 49232, 49233, 49245, 49246, 49247, 49249, 49252, 49253, 49254, 49255, 49256, 49257, 49262, 49265, 49266, 49267, 49268, 49269, 49270, 49273, 49274, 49275, 49277, 49278, 49280, 49282, 49283, 49284, 49285, 49286, 49287, 49288, 49289, 49290, 49291, 49292, 49293, 49299, 49300, 49301, 49302, 49304, 49307, 49308, 49309, 49312, 49313, 49314, 49315, 49321, 49339, 49340, 49342, 49343, 49345, 49346, 49347, 49350, 49358, 49359, 49365, 49376, 49378, 49379, 49398, 49402, 49406, 49419, 49425, 49426, 49433, 49440

JET AIRCRAFT
48618, 48674, 48822, 48894, 49159, 49203, 49205, 49404

K

KANAGAWA PREFECTURE
49292, 49342, 49345

KANSAS
49387, 49410, 49413

KENTUCKY
49395, 49414

KEROSENE
48638, 48775, 49220

KETONES
48626, 48752, 49015, 49312

KIDNEYS
49289

KILNS
48621, 48657, 48814, 48924, 48938, 49375

KRAFT (SULFATE) PULPING
48641, 48666, 48713, 48924, 48974

L

LABORATORY ANIMALS
49242, 49249, 49282

LABORATORY FACILITIES
49215

LAKES
49344

LAND USE PLANNING
49339, 49368, 49377, 49399, 49421, 49431, 49435

LANDFILLS
48633, 48672, 48860

LAPSE CONDITION
49180

LASERS
48970, 48977, 49018, 49023, 49027, 49028, 49050, 49065, 49078, 49086, 49087, 49097, 49235

LEAD
48750

LEAD ALLOYS
48750

LEAD COMPOUNDS
48637, 48639, 48647, 48649, 48655, 48731, 48746, 48750, 48753, 48775, 48819, 48913, 48929, 48973, 48978, 49034, 49110, 49125, 49127, 49195, 49238, 49243, 49244, 49251, 49252, 49255, 49259, 49260, 49302, 49306, 49310, 49316, 49319, 49320, 49337, 49345, 49411, 49428

LEAVES
49100, 49151, 49241, 49336, 49339, 49341, 49342, 49344, 49345, 49349, 49354

LEGISLATION
49236, 49255, 49261, 49362, 49372, 49379, 49390, 49391, 49398, 49399, 49400, 49402, 49407, 49416, 49417, 49418, 49424, 49425, 49428, 49432, 49433

LEUKOCYTES
49244, 49289

LIDAR
48997, 49011, 49017, 49065, 49078, 49108, 49137, 49170, 49171, 49173

LIGHT SCATTERING
48676, 48977, 49017, 49063, 49078, 49098, 49171, 49197, 49198, 49205

LIGHT-DUTY VEHICLES
48628, 48630, 48693, 48759, 48768, 48801, 48825, 48855, 48888, 48894, 48901, 48917, 48925, 48941, 48973, 49043, 49066, 49127, 49282

LIME KILNS
48814, 48924, 49375

LIMESTONE
48750, 48796

LINE SOURCES
48682, 49147, 49207

LIPIDS
49276

LITIGATION
49411, 49432

LIVER
49258, 49268, 49309, 49326

LOCAL GOVERNMENTS
49432

LONDON
48978, 49271

LOS ANGELES
48693, 49130

LOWER ATMOSPHERE
48667, 49011, 49087, 49098, 49132, 49135, 49136, 49137, 49138, 49139, 49140, 49161, 49162, 49170, 49173, 49184, 49189, 49193, 49201, 49202, 49205, 49404

LUNG CANCER
49268, 49271, 49278, 49294, 49307

LUNG CLEARANCE
49269, 49283, 49317, 49318

LUNGS
48690, 49242, 49248, 49250, 49266, 49271, 49281, 49289, 49315, 49316, 49318, 49322, 49326

M

MAGNESIUM COMPOUNDS
49114, 49115, 49182

MAGNETIC PROPERTIES
48655, 49158

MAGNETOHYDRODYNAMICS (MHD)
48897

MAINTENANCE
48626, 48712, 48732, 48745, 48752, 48783, 48806, 48813, 48834, 48843, 48877, 48897, 48911, 48919, 48922, 48930, 48934, 48936, 48937, 48992, 49372, 49400

MANGANESE COMPOUNDS
48649, 48913, 49034, 49112, 49114, 49140, 49195, 49345

MANUAL
49069

MANUFACTURING INDUSTRIES
48626, 48639, 48640, 48641, 48659, 48666, 48713, 48714, 48718, 48728, 48745, 48760, 48784, 48806, 48813, 48831, 48876, 48897, 48906, 48911, 48913, 48916, 48923, 48924, 48930, 48934, 48938, 48944, 48953, 48974, 49100, 49105, 49126, 49157, 49349, 49375, 49411

MAPPING
49204, 49399

MARYLAND
49354

MASS SPECTROMETRY
48996, 49006, 49052, 49058, 49095, 49119

MASSACHUSETTS
48685

MATHEMATICAL ANALYSES
48646, 48673, 48674, 48675, 48682, 48691, 48698, 48700, 48718, 48762, 48764, 48792, 48864, 48918, 48940, 48951, 48966, 48972, 48974, 48982, 48986, 49003, 49019, 49024, 49086, 49088, 49120, 49132, 49137, 49146, 49147, 49149, 49150, 49156, 49164, 49166, 49168, 49171, 49175, 49176, 49185, 49188, 49190, 49194, 49198, 49205, 49206, 49207, 49208, 49211, 49222, 49230, 49232, 49234, 49237, 49238, 49239, 49259, 49317, 49360, 49368, 49399, 49415, 49421, 49442

MATHEMATICAL MODELING
48673, 48674, 48682, 48698, 48718, 48918, 48940, 49120, 49132, 49150, 49156, 49166, 49171, 49176, 49185, 49194, 49198, 49205, 49206, 49207, 49211, 49259, 49317, 49360, 49368, 49399, 49415, 49421, 49442

MAXIMUM ALLOWABLE CONCENTRATION
48690, 48693, 48913, 49298, 49443

MEMBRANE FILTRATION
48950, 48964, 48973, 48978, 49052, 49072, 49073

MERCAPTANS
48626, 48641, 48670, 48710, 48738, 48858, 48934, 48949, 49058

MERCURY COMPOUNDS
48619, 48655, 48690, 48774, 48913, 48943, 48984, 49034, 49076, 49236, 49243, 49333, 49433

METABOLISM
49311, 49317, 49319, 49325, 49330

METAL COMPOUNDS
48619, 48625, 48626, 48629, 48637, 48639, 48642, 48647, 48649, 48654, 48655, 48669, 48680, 48690, 48731, 48733, 48739, 48746, 48750, 48753, 48774, 48775, 48795, 48796, 48806, 48819, 48828, 48890, 48913, 48929, 48943, 48951, 48953, 48973, 48978, 48984, 49024, 49034, 49036, 49061, 49076, 49091, 49101, 49110, 49112, 49114, 49115, 49125, 49127, 49140, 49182, 49195, 49208, 49217, 49236, 49238, 49241, 49243, 49244, 49251, 49252, 49255, 49259, 49260, 49263, 49297, 49302, 49306, 49310, 49312, 49316, 49317, 49319, 49320, 49325, 49327, 49330, 49331, 49333, 49337, 49342, 49345, 49350, 49411, 49428, 49433

METAL FABRICATION
48639, 48806, 48831, 48924, 48953, 48974

METAL INDUSTRIES
48718, 48760, 48924, 48938, 49375

METAL POISONING
48690, 49034, 49110, 49244, 49251, 49268, 49297, 49320, 49433

METALS
48741, 48750, 48771, 48827, 48851, 48897, 48922, 48924, 48974, 49357, 49358, 49364

METEOROLOGICAL INSTRUMENTS
49077, 49120, 49171, 49176, 49193, 49201, 49202

METEOROLOGY
48620, 48646, 48667, 48674, 48676, 48682, 48685, 48690, 48697, 48948, 48961, 48973, 49013, 49019, 49022, 49054, 49063, 49098, 49110, 49116, 49118, 49123, 49126, 49128, 49129, 49132, 49133, 49134, 49135, 49139, 49141, 49143, 49146, 49148, 49150, 49152, 49153, 49154, 49156, 49157, 49158, 49159, 49160, 49162, 49163, 49164, 49165, 49166, 49167, 49168, 49169, 49170, 49174, 49176, 49177, 49178, 49180, 49181, 49182, 49186, 49187, 49189, 49191, 49192, 49193, 49194, 49195, 49196, 49197, 49199, 49200, 49201, 49202, 49204, 49205, 49206, 49207, 49208, 49209, 49211, 49212, 49213, 49259, 49335, 49344, 49358, 49377, 49404, 49406, 49415, 49419, 49420, 49441

METHANES
48633, 48660, 49031, 49038, 49089, 49113, 49292

METROPOLITAN AREAS
48627, 48642, 48645, 48685, 48693, 48973, 48978, 49001, 49040, 49041, 49042, 49096, 49101, 49102, 49103, 49104, 49106, 49107, 49109, 49112, 49117, 49121, 49122, 49123, 49130, 49136, 49143, 49152, 49166, 49167, 49172, 49185, 49196, 49197, 49206, 49232, 49243, 49253, 49254, 49265, 49267, 49270, 49273, 49285, 49288, 49290, 49292, 49301, 49304, 49305, 49306, 49320, 49342, 49368, 49372, 49394, 49399

MICE
49258, 49289, 49307, 49311, 49315, 49327, 49337

MICROMETEOROLOGY
48685, 48973, 49159, 49189, 49192, 49205, 49377

MICROORGANISMS
48668, 48697, 48928, 49241, 49246, 49309, 49315, 49329, 49356, 49440

MICROSCOPY
48950, 48964, 49158

MIDDLE ATMOSPHERE
48667, 49098, 49120, 49132, 49138, 49139, 49140, 49159, 49161, 49162, 49171, 49172, 49173, 49189, 49203, 49205, 49221, 49264, 49404

MINERAL PROCESSING
48621, 48622, 49375

MINING
48634, 48681, 48913, 48968, 49411

MISSILE AND SPACECRAFT LAUNCH VEHICLES
48667, 48676, 49077, 49181

MISSISSIPPI
49389

MISSOURI
49206, 49385, 49393

MISTS
48800, 48889, 48923, 48946, 48976, 49262

MOBILE EMISSION SOURCES
48618, 48627, 48628, 48630, 48643, 48665, 48667, 48674, 48676, 48682, 48685, 48693, 48699, 48722, 48759, 48768, 48801, 48822, 48825, 48850, 48855, 48865, 48878, 48888, 48894, 48901, 48913, 48917, 48925, 48929, 48936, 48941, 48973, 49043, 49066, 49077, 49110, 49124, 49127, 49139, 49159, 49181, 49200, 49203, 49205, 49247, 49261, 49267, 49282, 49369, 49390, 49394, 49398, 49404, 49428, 49438

MONITORING
48678, 48680, 48718, 48806, 48948, 48955, 48961, 48962, 48967, 48970, 48971, 48973, 48974, 48994, 48996, 49004, 49008, 49011, 49017, 49021, 49023, 49025, 49027, 49028, 49032, 49048, 49049, 49050, 49055, 49056, 49065, 49067, 49077, 49078, 49079, 49081, 49082, 49085, 49086, 49087, 49088, 49131, 49197, 49202, 49215, 49236, 49243, 49251, 49348, 49399, 49406, 49419, 49420, 49426, 49428

MONTHLY
49106, 49313

MORBIDITY
49242, 49253, 49254, 49265, 49271, 49287, 49307, 49313, 49428

MORTALITY
49242, 49250, 49278, 49298, 49428

MOUNTAINS
48965, 49170

MUTAGENESIS
48640, 49309

N

NAPHTHALENES
48788, 48789

NAPHTHENES
48650

NATIONAL GOVERNMENTS
49380, 49418, 49427, 49432

NATURAL EMISSION SOURCES
48667, 49173

NATURAL GAS
48720

NECROSIS
49354

NERVOUS SYSTEM
48690, 49250, 49268, 49302, 49324

NETHERLANDS
49055, 49057, 49222

NEUTRAL CONDITION
49135

NEUTRON ACTIVATION ANALYSIS
49001

NEVADA
49388

NEW JERSEY
49335, 49431

NEW YORK CITY
49110

NEW YORK STATE
49110, 49416

NICKEL COMPOUNDS
48649, 48655, 48828, 49034, 49036, 49110, 49115, 49243, 49297, 49345

NITRATES
48967, 49037, 49040, 49101, 49111, 49182, 49200, 49209, 49332, 49335, 49346, 49352

NITRIC ACID
49276

NITRIC OXIDE (NO)
48618, 48638, 48644, 48665, 48686, 48709, 48770, 48771, 48780, 48797, 48818, 48827, 48871, 48873, 48918, 49055, 49079, 49086, 49099, 49102, 49118, 49128, 49142, 49150, 49289, 49293

NITROGEN
48639, 48692, 49221, 49292

NITROGEN DIOXIDE (NO2)
48618, 48638, 48644, 48709, 48770, 48780, 48827, 48958, 48962, 48979, 48994, 49055, 49077, 49079, 49086, 49099, 49102, 49105, 49118, 49119, 49120, 49124, 49127, 49128, 49150, 49242, 49252, 49261, 49266, 49276, 49283, 49289, 49293, 49313, 49328, 49341, 49346, 49348, 49376

NITROGEN ORGANIC COMPOUNDS
48636, 48710, 48980, 49094, 49260

NITROGEN OXIDES
48618, 48626, 48628, 48630, 48638, 48639, 48643, 48644, 48652, 48664, 48665, 48673, 48674, 48686, 48687, 48688, 48691, 48692, 48700, 48709, 48746, 48749, 48753, 48757, 48759, 48768, 48769, 48770, 48771, 48780, 48787, 48794, 48797, 48804, 48805, 48818, 48825, 48827, 48835, 48855, 48858, 48871, 48872, 48873, 48881, 48883, 48884, 48888, 48894, 48895, 48909, 48911, 48913, 48917, 48918, 48926, 48929, 48932, 48958, 48962, 48979, 48981, 48988, 48994, 49007, 49008, 49012, 49055, 49058, 49066, 49077, 49079, 49086, 49089, 49099, 49102, 49103, 49104, 49105, 49118, 49119, 49120, 49124, 49125, 49127, 49128, 49129, 49133, 49139, 49142, 49150, 49159, 49183, 49203, 49221, 49242, 49252, 49255, 49257, 49261, 49266, 49275, 49276, 49279, 49283, 49289, 49293, 49313, 49328, 49341, 49346, 49348, 49367, 49370, 49376, 49431, 49442

NITROUS OXIDE (N2O)
49089

NON-METROPOLITAN AREAS
48627, 48651, 48661, 48670, 48791, 48927, 48965, 49136, 49253, 49271, 49306, 49320, 49331, 49344, 49355, 49394, 49400

NORTH CAROLINA
49182, 49392

NORWAY
48767, 48868, 49200

NUCLEAR POWER PLANTS
48684, 48689, 49377

NUCLEATION
49098, 49213, 49217

NUCLEIC ACIDS
49258, 49309

O

OCEANS
49113, 49147, 49195

ODOR CONTROL
48659, 48661, 48668, 48710, 48713, 48738, 48745, 48748, 48772, 48778, 48791, 48813, 48831, 48863, 48886, 48893, 48927, 48934, 49149, 49400, 49438

ODOR COUNTERACTION
48659, 48661, 48668, 48710, 48713, 48738, 48745, 48748, 48772, 48778, 48791, 48813, 48831, 48863, 48886, 48893, 48927, 48934, 49149, 49400, 49438

ODORIMETRY
48659, 48778, 48966, 48975, 49000, 49014, 49019, 49029, 49030, 49044, 49062, 49222, 49434

ODOROUS POLLUTANTS
48626, 48636, 48641, 48651, 48653, 48659, 48661, 48666, 48668, 48670, 48710, 48713, 48738, 48745, 48748, 48772, 48778, 48791, 48813, 48831, 48857, 48893, 48897, 48934, 48966, 48975, 48993, 49000, 49018, 49019, 49029, 49030, 49044, 49057, 49062, 49127, 49149, 49222, 49272, 49346, 49400, 49426, 49434, 49438

OHIO
49344

OIL BURNERS
48881, 49110

OLEFINS
48831, 48947, 49038, 49335, 49343

OPEN BURNING
49409

OPEN HEARTH FURNACES
48938

OPERATING CRITERIA
49286, 49369, 49370, 49373, 49391

OPERATING VARIABLES
48618, 48652, 48660, 48665, 48686, 48688, 48691, 48715, 48718, 48720, 48723, 48737, 48739, 48751, 48783, 48797, 48803, 48811, 48819, 48835, 48842, 48843, 48846, 48851, 48861, 48870, 48874, 48875, 48893, 48897, 48901, 48932, 48937, 49012, 49016, 49053, 49070, 49082, 49225, 49373

OPINION SURVEYS
49272, 49438

OPTICAL METHODS
48950, 48964, 49158

ORCHARDS
49151

ORGANIC ACIDS
48626, 48653, 48737, 48796, 49015, 49041, 49094, 49312

ORGANIC DISEASES
49325

ORGANIC WASTES
48626, 48651, 48666, 48668, 48670, 48767, 48791, 48863, 48927, 49400

ORGANOMETALLICS
48973, 48978, 49241

OSAKA
49101, 49185, 49267, 49285, 49288, 49313

OVERFIRE AIR
48660

OXIDANTS
48636, 48693, 48958, 48967, 49040, 49119, 49124, 49125, 49150, 49160, 49165, 49169, 49192, 49257, 49261, 49270, 49274, 49285, 49321, 49341, 49344, 49352, 49376, 49429

OXIDATION
48718, 48721, 48738, 48745, 48757, 48778, 48780, 48809, 48831, 48851, 48934, 48953, 48967

OXYGEN
48660, 48770, 49197, 49205, 49214, 49221

OZONE
48626, 48639, 48693, 48738, 48928, 48959, 48962, 49055, 49079, 49097, 49113, 49119, 49120, 49124, 49128, 49132, 49138, 49139, 49145, 49146, 49159, 49172, 49189, 49198, 49203, 49205, 49221, 49245, 49264, 49266, 49276, 49280, 49281, 49293, 49315, 49335, 49338, 49346, 49352, 49376, 49404

OZONESONDES
49120

P

PACKED TOWERS
48813

PAINTS AND ALLIED PRODUCTION
48953

PAPER AND ALLIED MANUFACTURING
48641, 48666, 48713, 48897, 48924, 48938, 48974, 49105, 49126, 49375

PAPER MILLS
48897, 48938, 49105, 49126, 49375

PARTICLE COUNTING
48964, 48970, 48990, 49010, 49083, 49098, 49171

PARTICLE GROWTH
48627, 48719, 48812, 48859, 49208, 49213, 49217, 49235

PARTICLE INVESTIGATION METHODS
48950, 48951, 48952, 48964, 48970, 48973, 48977, 48978, 48982, 48989, 48990, 49003, 49010, 49049, 49052, 49053, 49054, 49072, 49073, 49083, 49087, 49092, 49098, 49171, 49197

PARTICLE SEPARATION
48950, 48952, 48964, 48973, 48978, 49052, 49053, 49054, 49072, 49073

PARTICLE SHAPE
48950, 48985, 49223, 49224

PARTICLE SIZE
48627, 48642, 48654, 48655, 48686, 48719, 48732, 48744, 48798, 48812, 48819, 48829, 48860, 48924, 48937, 48951, 48970, 48973, 48974, 48977, 48982, 48985, 48989, 48991, 49003, 49009, 49010, 49017, 49020, 49022, 49049, 49080, 49083, 49087, 49098, 49110, 49114, 49115, 49116, 49141, 49158, 49170, 49171, 49197, 49208, 49223, 49224, 49227, 49228, 49234, 49235, 49318, 49323

PARTICULATE CLASSIFICATION METHODS
48954, 49010, 49045

PARTICULATE SAMPLING
48961, 48971, 48978, 48991, 48992, 49004, 49010, 49016, 49045, 49049, 49070, 49072, 49073, 49082, 49088, 49136, 49234, 49323

PATHOLOGICAL TECHNIQUES
49249, 49250, 49275, 49284, 49289, 49295, 49296, 49314, 49324

PENELEC PROCESS
48718

PENNSYLVANIA
49372

PERFORMANCE STANDARDS
48620, 48684, 48690, 48768, 48925, 48929, 48935, 48941, 49255, 49362, 49370, 49374, 49375, 49381, 49382, 49385, 49393, 49397, 49398, 49407, 49415, 49422, 49424, 49425, 49429

PERMITS
49424

PEROXIDES
49221

PEROXYACETYL NITRATE
49332, 49346, 49352

PEROXYACYL NITRATES
49037, 49332, 49335, 49346, 49352

PESTICIDES
48626, 48636, 49195, 49311

PETER SPENCE PROCESS (CLAUS)
48910

PETROLEUM AND COAL PRODUCTS INDUSTRY
48714, 48728, 48784, 48911, 48913, 48916, 48934, 48944, 49157, 49375, 49411

PETROLEUM DISTRIBUTION
48721, 48892, 49411

PETROLEUM PRODUCTION
48681, 48913, 49411

PETROLEUM REFINING
48714, 48728, 48784, 48911, 48913, 48916, 48934, 48944, 49157, 49375, 49411

PETUNIA
49338

PH
48842, 49133, 49134, 49196, 49233, 49327

PHENOLS
48683, 48752, 48831, 49261

PHENYL COMPOUNDS
48831, 49312

PHENYLS
48831, 49312

PHILADELPHIA
49372

PHOSPHORUS COMPOUNDS
48692, 49182, 49250

PHOTOCHEMICAL REACTIONS
49120, 49132, 49138, 49139, 49150, 49159, 49161, 49162, 49166, 49172, 49189, 49203, 49214, 49218, 49221, 49231, 49264, 49274, 49279, 49282, 49332, 49341, 49344

PHOTOELECTRIC PHENOMENA
49231

PHOTOGRAPHIC METHODS
48970, 49025, 49087, 49103, 49235, 49349

PHOTOLYSIS
49161

PHOTOMETRIC METHODS
48949, 49002, 49004, 49010, 49060, 49073, 49197, 49198

PHOTOOXIDATION
49218

PHOTOSYNTHESIS
49133, 49332, 49341

PHTHALIC ACID
49041

PHYTOTOXICANTS
49311, 49354

PILOT PLANTS
48737, 48745, 48755, 48807, 48828, 48832, 48842, 48852, 48861, 48862, 48883, 48896, 48943

PLANNING AND ZONING
48674, 48682, 49129, 49149, 49204, 49339, 49368, 49377, 49399, 49403, 49408, 49421, 49431, 49435

PLANT DAMAGE
48626, 48636, 49105, 49334, 49335, 49339, 49341, 49343, 49344, 49347, 49349, 49352, 49354, 49366

PLANT GROWTH AND DEVELOPMENT
49105, 49133, 49332, 49334, 49341, 49343, 49350, 49354

PLANT INDICATORS
49100, 49333, 49345, 49346, 49349, 49350, 49351, 49353, 49355, 49356

PLASTICS
48741, 48823, 49439

PLATING AND POLISHING
48953

PLATINUM
48771, 49364

PLUME BEHAVIOR
48631, 48974, 49132, 49135, 49137, 49159, 49177, 49190, 49194, 49206, 49211, 49212

PNEUMOCONIOSIS
48634, 49248, 49271, 49294, 49307

POINT SOURCES
48682, 48687, 49135, 49147, 49185, 49204, 49206

POLAROGRAPHIC METHODS
48955

POLLENS
48636, 49136

POLYNUCLEAR COMPOUNDS
48683, 48788, 48789, 49041, 49091, 49095, 49101, 49155, 49241, 49255, 49295, 49296, 49303, 49307, 49309

POTASSIUM COMPOUNDS
48642, 49110, 49115, 49140, 49182

POTENTIOMETRIC METHODS
48972, 49012, 49069, 49073, 49079, 49286

POULTRY
48651, 48659

POWER SOURCES
48618, 48620, 48628, 48635, 48643, 48644, 48665, 48673, 48702, 48706, 48717, 48727, 48729, 48731, 48740, 48753, 48757, 48761, 48769, 48771, 48777, 48781, 48782, 48787, 48802, 48809, 48815, 48820, 48821, 48822, 48835, 48837, 48848, 48854, 48870, 48877, 48880, 48894, 48898, 48899, 48905, 48918, 48929, 48936, 48960, 49043, 49225, 49235, 49369, 49438

PRECIPITATION
48667, 48690, 49013, 49116, 49133, 49143, 49157, 49158, 49162, 49163, 49182, 49196, 49200, 49208, 49209, 49419

PRESSURE (ATMOSPHERIC)
48620, 49143, 49165, 49178, 49200

PROCESS MODIFICATION
48638, 48650, 48660, 48662, 48664, 48665, 48681, 48686, 48688, 48691, 48720, 48722, 48740, 48770, 48776, 48782, 48797, 48806, 48808, 48817, 48825, 48830, 48844, 48869, 48871, 48872, 48881, 48882, 48883, 48884, 48894, 48895, 48909, 48911, 48920, 48922, 48925, 48930, 48932, 48933, 49225

PROPANES
48947, 49031, 49038

PROPENES
49038

PROPOSALS
48674, 48929, 49411, 49414

PROTEINS
49244, 49251, 49281, 49315, 49334

PUBLIC AFFAIRS
48670, 48678, 49127, 49272, 49361, 49419, 49426, 49432, 49437, 49438

PULMONARY FUNCTION
49263, 49277, 49279, 49283, 49300, 49301, 49305, 49308, 49322, 49328, 49374

PULMONARY RESISTANCE
49300, 49301, 49328

PULP MILLS
48641, 48666, 48713, 48924, 48974

PULVERIZED FUELS
48754, 48797, 48915, 48924

PYRENES
48683, 49041, 49101, 49255, 49295, 49296, 49303, 49307

PYROLYSIS
48652, 48660, 48672, 48726, 48779, 49083

R

RABBITS
49244, 49280, 49314, 49324

RADIATION MEASURING SYSTEMS
49084, 49198

RADIOACTIVE RADIATION
48919, 48971, 49024, 49323

RADIOACTIVE TRACERS
49024, 49316, 49327, 49333

RADIOLOGICAL HEALTH
49268

RADIOSONDES
49120

RAGWEED POLLEN
49136

RAILROAD VEHICLES
48628

RAIN
48690, 49013, 49116, 49133, 49143, 49162, 49196, 49209, 49419

RAPPING
48732, 48783, 48915

RATS
49241, 49250, 49263, 49275, 49281, 49297, 49298, 49302, 49309, 49318, 49324, 49325, 49326, 49330

REACTION KINETICS
48709, 48738, 48873, 48904, 48940, 48945, 48967, 49159, 49189, 49208, 49214, 49218, 49220, 49221, 49240, 49332

REACTION MECHANISMS
48660, 48688, 48709, 48738, 48851, 48873, 48904, 48940, 48945, 48967, 49159, 49189, 49208, 49214, 49218, 49220, 49238, 49240, 49276

REACTORS (NUCLEAR)
48684

RECORDING METHODS
48948, 48955, 48970, 48990, 49011, 49025, 49087, 49103, 49215, 49235, 49349

RECREATION AREAS
48965

REDUCTION
48695, 48757, 48759, 48787, 48827, 48909, 48934, 48941, 49233

REFRACTIVE INDEX
48977, 49087, 49171

REFUSE SYSTEMS
48626, 48633, 48634, 48640, 48651, 48652, 48660, 48662, 48666, 48668, 48670, 48671, 48672, 48685, 48688, 48694, 48699, 48700, 48713, 48714, 48716, 48752, 48765, 48767, 48791, 48813, 48817, 48823, 48860, 48863, 48875, 48882, 48897, 48923, 48927, 49100, 49375, 49400, 49408, 49426

REGULATIONS
48912, 48929, 49363, 49369, 49377, 49380, 49383, 49388, 49390, 49391, 49394, 49398, 49407, 49409, 49411, 49414, 49418, 49422, 49424, 49425, 49428, 49435

RENDERING PLANTS, GREASE AND TALLOW
48626, 48813

REPRODUCTION (BIOLOGICAL)
48640, 49249, 49258, 49284, 49298, 49302, 49310, 49311

RESEARCH METHODOLOGIES
49308, 49375

RESEARCH PROGRAMS
48674, 48681, 48856, 49231, 49404, 49423, 49427, 49430

RESIDENTIAL AREAS
49006, 49119, 49124, 49367

RESIDUAL OILS
48629, 48638, 48725, 48728, 48793, 48874, 48944, 49220

RESPIRATORY DISEASES
48634, 48906, 49242, 49247, 49248, 49250, 49253, 49254, 49262, 49265, 49266, 49268, 49269, 49271, 49273, 49274, 49275, 49276, 49283, 49287, 49288, 49290, 49291, 49294, 49299, 49300, 49307, 49308, 49313, 49314, 49315, 49326, 49328, 49433

RESPIRATORY SYSTEM
48655, 48690, 49080, 49242, 49248, 49250, 49253, 49266, 49271, 49274, 49281, 49283, 49289, 49293, 49296, 49297, 49303, 49315, 49316, 49318, 49322, 49323, 49326, 49328

RETENTION
48690, 49110, 49134, 49297, 49306, 49310, 49316, 49317, 49319, 49322, 49323, 49331, 49337, 49340

RINGELMANN CHART
49075

ROADS
48643, 48646, 48658, 48682, 48814, 48921, 48973, 49102, 49118, 49124, 49127, 49142, 49144, 49156, 49207, 49247, 49304, 49305, 49337, 49367, 49394

ROTARY ENGINES
48761

ROTARY PISTON ENGINES
48761

RUBBER
48658

RUBBER AND MISCELLANEOUS PLASTICS PRODUC
48640

RUBBER PRODUCTION
48640

S

SAFETY EQUIPMENT
48640

SALTZMAN METHOD (NOX)
48962, 48979, 48981, 49037, 49376

SAMPLERS
48956, 48958, 48960, 48961, 48975, 48984, 48991, 48992, 48995, 49016, 49026, 49032, 49033, 49039, 49042, 49051, 49071, 49072, 49219, 49234

SAN FRANCISCO
49128, 49391

SANITARY SERVICES
48625, 48626, 48633, 48634, 48640, 48651, 48652, 48660, 48662, 48666, 48668, 48670, 48671, 48672, 48685, 48688, 48694, 48699, 48700, 48710, 48713, 48714, 48716, 48748, 48752, 48765, 48767, 48791, 48813, 48814, 48817, 48823, 48860, 48863, 48875, 48882, 48897, 48923, 48927, 49100, 49375, 49400, 49408, 49426

SAPPORO
49106, 49107, 49122, 49123

SCANDINAVIA
48767, 48868, 49019, 49149, 49196, 49200, 49271, 49272, 49375

SCATTERING (ATMOSPHERIC)
49011, 49087, 49108, 49171, 49173, 49197, 49198

SCREEN FILTERS
48916

SCRUBBERS
48625, 48626, 48640, 48710, 48716, 48719, 48736, 48743, 48745, 48760, 48764, 48766, 48774, 48793, 48795, 48796, 48798, 48799, 48805, 48806, 48807, 48812, 48813, 48823, 48832, 48836, 48841, 48842, 48843, 48847, 48852, 48853, 48860, 48861, 48862, 48867, 48875, 48876, 48882, 48887, 48889, 48896, 48902, 48909, 48911, 48912, 48922, 48923, 48932, 48937, 48938, 48939, 48946, 49439

SEA BREEZE
49186

SEA SALTS
48667, 49110, 49140

SECONDARY AIR
48895

SEDIMENTATION PHENOMENA
48882, 49217, 49239

SELENIUM COMPOUNDS
48619, 48655, 49195, 49329

SETTLING CHAMBERS
48806, 48922, 48923

SETTLING PARTICLES
48636, 48637, 48638, 48640, 48648, 48649, 48650, 48654, 48657, 48663, 48667, 48669, 48671, 48676, 48689, 48697, 48715, 48732, 48744, 48755, 48760, 48767, 48785, 48793, 48804, 48806, 48807, 48808, 48810, 48816, 48819, 48859, 48875, 48883, 48891, 48900, 48906, 48918, 48919, 48922, 48923, 48924, 48930, 48937, 48946, 48950, 48954, 48968, 48982, 48983, 48990, 48991, 48992, 49034, 49009, 49010, 49016, 49022, 49026, 49036, 49051, 49082, 49085, 49095, 49103, 49110, 49112, 49125, 49126, 49133, 49140, 49141, 49155, 49157, 49158, 49172, 49198, 49217, 49224, 49238, 49243, 49263, 49271, 49283, 49294, 49326, 49424, 49428

SEWERAGE SYSTEMS
48625, 48662, 48710, 48748, 48814, 48860, 48875

SHEEP
48636

SILICATES
49233

SILICON COMPOUNDS
48642, 49115, 49140, 49233

SILICON DIOXIDE
48639, 48767, 49238

SILVER COMPOUNDS
49208

SIMULATION
48618, 48660, 48682, 48973, 49129, 49177, 49183, 49184, 49211, 49224, 49259, 49317, 49401

SINTERING
48718, 48924, 48938, 49375

SKIN CANCER
49264, 49268

SLUDGE
48625, 48662, 48748, 48814, 48860, 48875

SMOG
48759, 49097, 49150, 49160, 49164, 49165, 49255, 49262, 49270, 49274, 49282, 49285, 49321, 49338, 49419

SMOKE SHADE
48620, 48974, 49017, 49075

SMOKEMETERS
48620, 48894, 48974, 49017

SMOKES
48620, 48636, 48639, 48644, 48665, 48716, 48720, 48731, 48759, 48776, 48822, 48823, 48835, 48857, 48869, 48894, 48907, 48918, 48929, 48936, 48945, 49075, 49235, 49250, 49371, 49409, 49424, 49428

SMOKING
49099, 49278, 49305, 49319

SNOW
49157, 49158, 49196

SOCIAL ATTITUDES
49272, 49434, 49435, 49437, 49438

SOCIO-ECONOMIC FACTORS
48839, 48929, 48933, 49236, 49335, 49360, 49361, 49363, 49364, 49366, 49367, 49368, 49374, 49379, 49399, 49401, 49404, 49408, 49435, 49436, 49437, 49443

SODIUM CARBONATE
48795, 48796

SODIUM COMPOUNDS
48739, 48795, 48796, 48828, 49110, 49115, 49140, 49182

SODIUM HYDROXIDE
48795, 48796

SOILS
48680, 49024, 49116, 49134, 49195, 49210, 49246, 49329, 49333, 49337, 49348, 49350

SOLAR RADIATION
49087, 49128, 49133, 49146, 49197, 49198, 49203, 49205, 49264

SOLVENT REFINING
48920, 48933, 48944

SOLVENTS
48696, 48806, 48886, 48956, 49312

SOOT
48648, 48650, 48669, 48793, 48804, 48816, 48883, 48918, 49238

SOURCE MONITORING
48678, 48680, 48806, 48955, 48961, 48967, 48971, 48974, 48994, 49004, 49032, 49049, 49082, 49088

SOUTH CAROLINA
49384

SOUTH PACIFIC
49120, 49193

SOX CONTROL
48625, 48694, 48695, 48707, 48708, 48711, 48718, 48736, 48742, 48743, 48745, 48759, 48786, 48790, 48795, 48796, 48807, 48808, 48814, 48832, 48836, 48847, 48852, 48860, 48862, 48875, 48876, 48882, 48887, 48896, 48909, 48910, 48911, 48912, 48920, 48932, 48934, 48939, 49362

SPARK IGNITION ENGINES
48706, 48771, 48777, 48929, 48936

SPARK TIMING
48849, 48850, 48854, 48926

SPECTROMETRY
48943, 48957, 48978, 48983, 48987, 48994, 48996, 49001, 49006, 49020, 49021, 49025, 49027, 49028, 49034, 49037, 49043, 49052, 49058, 49067, 49077, 49081, 49086, 49089, 49090, 49094, 49095, 49119, 49197, 49198, 49231, 49235, 49260

SPECTROPHOTOMETRY
48953, 49018, 49050, 49069

SPORES
48928, 49356

SPRAY TOWERS
48760, 48766, 48799, 48823, 48876, 48946

SPRAYS
48923, 49022, 49172

ST LOUIS
49206

STABILITY (ATMOSPHERIC)
49011, 49135, 49137, 49148, 49153, 49154, 49157, 49166, 49180, 49191, 49193, 49200, 49201, 49202, 49204, 49206, 49211, 49259

STACK GASES
48622, 48629, 48631, 48637, 48640, 48641, 48642, 48647, 48652, 48662, 48664, 48669, 48671, 48680, 48681, 48684, 48688, 48689, 48690, 48691, 48694, 48695, 48704, 48708, 48709, 48711, 48712, 48713, 48714, 48718, 48735, 48736, 48739, 48743, 48745, 48747, 48752, 48754, 48755, 48760, 48765, 48766, 48770, 48774, 48780, 48783, 48788, 48790, 48793, 48795, 48796, 48798, 48799, 48804, 48805, 48806, 48808, 48810, 48816, 48817, 48823, 48824, 48828, 48829, 48830, 48832, 48838, 48840, 48842, 48845, 48847, 48853, 48857, 48858, 48860, 48866, 48868, 48869, 48876, 48882, 48886, 48887, 48889, 48891, 48900, 48902, 48906, 48909, 48910, 48911, 48912, 48914, 48923, 48924, 48930, 48931, 48932, 48934, 48938, 48939, 48946, 48952, 48954, 48955, 48961, 48967, 48971, 48974, 48988, 49005, 49012, 49013, 49017, 49032, 49045, 49049, 49065, 49075, 49082, 49088, 49091, 49125, 49137, 49149, 49177, 49185, 49190, 49199, 49211, 49224, 49229, 49371, 49375, 49398, 49422, 49424, 49442

STACK MONITORING
48806, 48967, 48974, 48994, 49032, 49049, 49082, 49088

STACKS
48631, 48640, 48752, 48804, 48806, 48808, 48869, 48909, 48911, 48923, 48934, 49177, 49185, 49204, 49229, 49424, 49439, 49442

STATE GOVERNMENTS
49388, 49390, 49409, 49410, 49412, 49413, 49416, 49417, 49418, 49432

STATIONARY EMISSION SOURCES
48618, 48619, 48621, 48622, 48623, 48625, 48626, 48627, 48628, 48629, 48630, 48633, 48634, 48636, 48637, 48638, 48639, 48640, 48641, 48642, 48645, 48647, 48648, 48649, 48650, 48651, 48652, 48654, 48657, 48659, 48660, 48662, 48663, 48664, 48666, 48667, 48668, 48670, 48671, 48672, 48673, 48675, 48677, 48678, 48679, 48680, 48681, 48683, 48684, 48685, 48688, 48689, 48690, 48691, 48692, 48694, 48695, 48699, 48700, 48701, 48703, 48707, 48710, 48713, 48714, 48716, 48718, 48720, 48721, 48724, 48725, 48726, 48728, 48730, 48733, 48736, 48739, 48742, 48745, 48746, 48748, 48752, 48754, 48756, 48760, 48765, 48767, 48768, 48770, 48771, 48772, 48775, 48777, 48779, 48783, 48784, 48786, 48791, 48793, 48795, 48796, 48797, 48799, 48804, 48806, 48807, 48810, 48811, 48813, 48814, 48817, 48822, 48823, 48825, 48828, 48829, 48831, 48832, 48836, 48842, 48843, 48844, 48852, 48856, 48858, 48860, 48862, 48863, 48871, 48872, 48874, 48875, 48876, 48881, 48882, 48883, 48884, 48886, 48890, 48892, 48895, 48896, 48897, 48902, 48904, 48906, 48908, 48909, 48910, 48911, 48912, 48913, 48914, 48915, 48916, 48920, 48921, 48923, 48924, 48927, 48930, 48932, 48933, 48934, 48935, 48938, 48939, 48943, 48944, 48953, 48954, 48968, 48974, 48985, 48988, 49008, 49013, 49033, 49036, 4904 49064, 49088, 49091, 49094, 49100, 49105, 49110, 49126, 49127, 49133, 49137, 49146, 49149, 49157, 49167, 49173, 49185, 49195, 49199, 49200, 49204, 49210, 49212, 49220, 49224, 49236, 49259, 49272, 49349, 49354,

49362, 49370, 49371, 49374, 49375, 49377, 49398, 49400, 49401, 49406, 49407, 49408, 49409, 49411, 49414, 49416, 49418, 49422, 49423, 49426, 49428, 49435, 49442, 49443

STATISTICAL ANALYSES
48646, 48739, 48951, 49003, 49024, 49035, 49063, 49101, 49107, 49119, 49122, 49128, 49131, 49148, 49153, 49178, 49179, 49180, 49243, 49272, 49294, 49305, 49320, 49352, 49399, 49442

STEAM
48868, 48907

STEAM ELECTRIC POWER GENERATION
48642, 48680, 48684, 48689, 48691, 48700, 48742, 48754, 48783, 48795, 48807, 48828, 48829, 48832, 48836, 48842, 48852, 48862, 48896, 48897, 48915, 48924, 48932, 48938, 48939, 49137, 49199, 49354, 49370, 49396, 49401

STEEL
48922, 49357, 49358

STRATIFIED CHARGE ENGINES
48837, 48848, 48936

STREETS
48646, 48973, 49124, 49144, 49304, 49305

STRUCTURES
48645, 48658, 48697, 48928, 49099

STYRENES
48831; 49312

SUBSURFACE STRUCTURES
48658

SULFATES
48625, 48626, 48642, 48679, 48737, 48768, 48814, 48967, 48976, 49092, 49101, 49111, 49196, 49209, 49261

SULFATION-OF-LEAD METHODS
49035

SULFIDES
48626, 48641, 48666, 48670, 48710, 48738, 48805, 48825, 48858, 48902, 48909, 48911, 48934, 48949, 48963, 48969, 48993, 49079, 49086, 49157, 49233, 49292

SULFITES
48814, 49058

SULFUR COMPOUNDS
48625, 48626, 48641, 48642, 48655, 48666, 48670, 48677, 48679, 48692, 48710, 48733, 48737, 48738, 48755, 48768, 48779, 48805, 48814, 48825, 48840, 48858, 48902, 48904, 48909, 48911, 48913, 48934, 48949, 48963, 48967, 48969, 48976, 48993, 49058, 49079, 49086, 49092, 49101, 49111, 49115, 49157, 49196, 49209, 49233, 49261, 49292, 49342, 49345, 49416

SULFUR DIOXIDE
48632, 48636, 48645, 48652, 48687, 48691, 48693, 48700, 48718, 48738, 48768, 48804, 48805, 48806, 48842, 48864, 48934, 48948, 48949, 48958, 48967, 48994, 48999, 49005, 49021, 49050, 49054, 49058, 49059, 49060, 49077, 49079, 49084, 49086, 49102, 49106, 49107, 49124, 49126, 49131, 49134, 49137, 49143, 49147, 49148, 49152, 49154, 49157, 49167, 49169, 49179, 49184, 49186, 49199, 49200, 49201, 49202, 49206, 49214, 49257, 49261, 49265, 49269, 49275, 49283, 49288, 49293, 49313, 49321, 49326, 49334, 49335, 49346, 49348, 49351, 49353, 49354, 49355, 49356, 49358, 49372, 49374, 49375, 49388, 49391, 49406, 49414, 49416, 49418, 49422, 49428, 49431, 49435

SULFUR ORGANIC COMPOUNDS
48626, 48641, 48670, 48679, 48710, 48738, 48858, 48934, 48949, 49058

SULFUR OXIDES
48626, 48632, 48636, 48645, 48647, 48652, 48673, 48687, 48691, 48692, 48693, 48700, 48718, 48720, 48737, 48738, 48754, 48768, 48804, 48805, 48806, 48842, 48858, 48864, 48911, 48913, 48923, 48930, 48932, 48934, 48948, 48949, 48958, 48967, 48994, 48999, 49005, 49008, 49021, 49035, 49050, 49054, 49058, 49059, 49060, 49077, 49079, 49084, 49086, 49102, 49103, 49104, 49105, 49106, 49107, 49122, 49123, 49124, 49125, 49126, 49127, 49131, 49133, 49134, 49137, 49143, 49147, 49148, 49152, 49154, 49157, 49167, 49169, 49178, 49179, 49184, 49186, 49188, 49199, 49200, 49201, 49202, 49206, 49214, 49221, 49232, 49255, 49257, 49261, 49262, 49265, 49269, 49275, 49279, 49283, 49288, 49293, 49300, 49313, 49321, 49326, 49334, 49335, 49346, 49348, 49351, 49353, 49354, 49355, 49356, 49358, 49362, 49372, 49374, 49375, 49378, 49388, 49391, 49406, 49414, 49416, 49418, 49422, 49428, 49431, 49435

SULFUR TRIOXIDE
48737, 48754, 48768, 48806, 48864, 48967, 49035, 49105

SULFURIC ACID
48626, 48768, 48931, 48976, 49300, 49261, 49262, 49354

SUPERSATURATION
49213

SURFACE PROPERTIES
48642, 48655, 48723, 48724, 48725, 48800, 48846, 48866, 48893, 49217, 49224, 49233, 49336

SURFACTANTS
48764

SURVEY METHODS
48967, 49125, 49378

SUSPENDED PARTICULATES
48619, 48620, 48636, 48639, 48642, 48644, 48649, 48655, 48665, 48680, 48690, 48700, 48711, 48716, 48720, 48731, 48737, 48750, 48754, 48759, 48776, 48795, 48800, 48806, 48812, 48814, 48822, 48823, 48835, 48857, 48860, 48864, 48869, 48889, 48890, 48894, 48907, 48913, 48915, 48918, 48921, 48922, 48923, 48929, 48936, 48945, 48946, 48967, 48976, 48985, 48995, 49001, 49004, 49007, 49008, 49017, 49022, 49041, 49058, 49075, 49097, 49101, 49110, 49111, 49119, 49125, 49136, 49150, 49160, 49164, 49165, 49208, 49216, 49217, 49229, 49235, 49250, 49255, 49262, 49270, 49274, 49282, 49285, 49321, 49338, 49354, 49371, 49409, 49419, 49424, 49428

SWEDEN
49019, 49149, 49196, 49272, 49375

SYNERGISM
49242, 49245, 49279, 49326, 49376

SYNTHETIC FIBERS
48741, 48800

T

TAR (MATERIAL)
48788, 48789

TARS (POLLUTANTS)
4909.

TAXATION
49401, 49402, 49408, 49422, 49425

TEFLON
48741

TEMPERATURE
48630, 48660, 48717, 48728, 48741, 48762, 48773, 48844, 48874, 48875, 48961, 49016, 49054, 49217, 49327

TEMPERATURE (ATMOSPHERIC)
48697, 49123, 49133, 49169, 49176, 49178, 49180, 49191, 49192, 49193, 49212, 49358

TEMPERATURE GRADIENT
49135

TENNESSEE
49182

TEST ENGINES
48758, 48917, 48926

TETRAETHYL LEAD
48775, 48929, 49238

TEXTILES
48732, 48741, 48800, 49371

THERMAL RADIATION
49377, 49404

THERMODYNAMICS
48719, 48764, 48904

THIN-LAYER CHROMATOGRAPHY
49006, 49091

THRESHOLDS
48966, 49251, 49259, 49261, 49274, 49298, 49415

TIMED FUEL INJECTION
48722, 48797, 48835, 48870, 48894, 48918, 48936, 48972

TIN
48750

TIN COMPOUNDS
49243

TIRES
48658

TISSUES
49110, 49271, 49284, 49297, 49310, 49314, 49317, 49337

TITANIUM COMPOUNDS
48642, 49114

TOKYO
48645, 48835, 49040, 49109, 49117, 49119, 49121, 49166, 49232, 49291, 49304, 49321

TOLUENES
48831, 48996, 49038, 49218, 49280

TOMATOES
49344

TOPOGRAPHIC INTERACTIONS
48973, 49135, 49146, 49156, 49172, 49174, 49177, 49204, 49207, 49239

TOXIC TOLERANCES
49242, 49272, 49338, 49339, 49341, 49347, 49351, 49353

TOXICITY
48624, 48626, 48636, 48639, 48655, 48690, 49034, 49236, 49242, 49244, 49245, 49246, 49250, 49255, 49256, 49259, 49261, 49272, 49274, 49279, 49281, 49289, 49297, 49298, 49312, 49324, 49326, 49329, 49332, 49339, 49343, 49347, 49376, 49415, 49442

TRACE ANALYSIS
48680, 48963, 48993, 48994, 49036, 49052, 49081, 49089, 49195, 49310

TRACERS
49024, 49219, 49316, 49327, 49333

TRACHEA
49293, 49296, 49303, 49326

TRACHEAL CANCER
49296

TRANSMISSOMETERS
48974, 49017

TRANSPORT
48627, 48634, 48685, 48692, 49024, 49077, 49132, 49136, 49140, 49147, 49149, 49159, 49160, 49167, 49168, 49170, 49176, 49181, 49194, 49195, 49196, 49200, 49206, 49207, 49210, 49344

TRANSPORTATION METHODS
48618, 48627, 48628, 48630, 48643, 48665, 48674, 48682, 48685, 48693, 48699, 48722, 48759, 48768, 48801, 48822, 48825, 48850, 48855, 48865, 48878, 48888, 48894, 48901, 48913, 48917, 48925, 48929, 48936, 48941, 48973, 49043, 49066, 49077, 49110, 49124, 49127, 49139, 49159, 49200, 49203, 49205, 49247, 49261, 49267, 49282, 49369, 49390, 49394, 49398, 49404, 49428, 49438

TRAPPING (SAMPLING)
48957, 49064

TREATED FABRICS
49039

TREES
49136, 49339, 49342, 49345, 49354

TRENDS
48645, 48647, 48648, 48649, 48673, 48734, 48779, 48897, 49010, 49125, 49126, 49127, 49133, 49138, 49350, 49428

TRUCKS
48628, 48643

TUMORS
49271, 49295, 49296, 49303, 49307, 49327

TUNNELS
48658

TURBIDIMETRY
48977, 49010, 49087, 49092, 49197

TURBULENCE (ATMOSPHERIC)
49191, 49194

U

ULTRAVIOLET RADIATION
49119, 49138, 49145, 49146, 49164, 49198, 49203, 49205, 49218, 49231, 49264, 49404

ULTRAVIOLET SPECTROMETRY
48943, 49197

UNDERFIRE AIR
48660, 48720

UNIDIRECTIONAL AEROSOL MOTION
48660, 48720

UNITED KINGDOM
48627, 48678, 48694, 48697, 48806, 48893, 48894, 48964, 48978, 49113, 49217, 49238, 49242, 49271, 49306, 49318, 4935[illegible], [illegible]9353, 49424, 49428

UNITED STATES
48685, 48687, 48693, 49110, 49128, 49130, 49173, 49182, 49206, 49210, 49335, 49344, 49348, 49352, 49354, 49372, 49381, 49382, 49383, 49384, 49385, 49386, 49387, 49388, 49389, 49390, 49391, 49392, 49393, 49394, 49395, 49396, 49410, 49412, 49413, 49414, 49416, 49417, 49431, 49432

UPPER ATMOSPHERE
49139, 49205

URBAN AREAS
48627, 48642, 48645, 48685, 48693, 48973, 48978, 49001, 49040, 49041, 49042, 49096, 49101, 49102, 49103, 49104, 49106, 49107, 49109, 49112, 49117, 49121, 49122, 49123, 49130, 49136, 49143, 49152, 49166, 49167, 49172, 49185, 49196, 49197, 49206, 49232, 49243, 49253, 49254, 49265, 49267, 49270, 49273, 49285, 49288, 49290, 49292, 49301, 49304, 49305, 49306, 49320, 49342, 49368, 49372, 49394, 49399

URINE
49251, 49260, 49268, 49286

USSR
48624, 48704, 48709, 48718, 48739, 48752, 48783, 48792, 48793, 48798, 48799, 48800, 48803, 48827, 48906, 48913, 48961, 49002, 49046, 49061, 49065, 49157, 49158, 49197, 49241, 49294, 49297, 49298, 49323, 49324, 49325, 49329, 49398, 49420, 49442

V

VANADIUM COMPOUNDS
48629, 48655, 48828, 48913, 49034, 49036, 49110, 49114, 49195, 49243, 49255

VAPOR PRESSURE
48717, 49016

VAPOR RECOVERY SYSTEMS
48696, 48705, 48721, 48892, 48911, 48934

VAPORS
48639, 48690, 48721, 48790, 48861, 48868, 48907, 48923, 48956, 49033, 49064, 49071, 49076, 49078, 49091, 49094, 49197, 49198, 49205, 49213, 49217, 49220, 49298

VEGETABLES
49344, 49348

VENTILATION
48639, 48697, 48930

VENTURI SCRUBBERS
48798, 48799, 48841, 48937

VESSELS (MARINE)
48685

VIRUSES
49315

VISIBILITY
48627, 49103, 49111

VISIBLE RADIATION
48676, 49197, 49198

VOLATILITY
48619, 48636, 48730, 48965, 48968

VOLCANOES
48667, 49173

VOLTAGE
48857, 48915

W

WASHOUT
48667, 48690, 49013, 49158, 49162, 49182, 49196, 49200, 49208, 49209

WASTE GAS CONTROL
48625, 48694, 48695, 48707, 48708, 48711, 48718, 48736, 48742, 48743, 48745, 48759, 48786, 48790, 48795, 48796, 48807, 48808, 48814, 48832, 48836, 48847, 48852, 48860, 48862, 48875, 48876, 48882, 48887, 48896, 48909, 48910, 48911, 48912, 48920, 48932, 48934, 48939, 49362

WASTE GASES
48622, 48629, 48631, 48637, 48640, 48641, 48642, 48647, 48652, 48662, 48664, 48669, 48671, 48680, 48681, 48684, 48688, 48689, 48690, 48691, 48694, 48695, 48704, 48708, 48709, 48711, 48712, 48713, 48714, 48718, 48735, 48736, 48739, 48743, 48745, 48747, 48752, 48754, 48755, 48760, 48765, 48766, 48770, 48774, 48780, 48783, 48788, 48790, 48793, 48795, 48796, 48798, 48799, 48804, 48805, 48806, 48808, 48810, 48816, 48817, 48823, 48824, 48828, 48829, 48830, 48832, 48838, 48840, 48842, 48845, 48847, 48853, 48857, 48858, 48860, 48866, 48868, 48869, 48876, 48882, 48886, 48887, 48889, 48891, 48900, 48902, 48906, 48909, 48910, 48911, 48912, 48914, 48923, 48924, 48930, 48931, 48932, 48934, 48938, 48939, 48946, 48952, 48954, 48955, 48961, 48967, 48971, 48974, 48988, 49005, 49012, 49013, 49017, 49032, 49045, 49049, 49065, 49075, 49082, 49088, 49091, 49125, 49137, 49149, 49177, 49185, 49190, 49199, 49211, 49224, 49229, 49371, 49375, 49398, 49422, 49424, 49442

WATER
48712, 48733, 48790, 48797, 48820, 48833, 48861, 48864, 48889, 48907, 49197, 49198, 49203, 49205, 49208, 49213, 49221, 49284, 49333

WATER BODIES
48625, 48680, 48692, 48699, 48700, 48882, 48943, 49013, 49127, 49350, 49426, 49433

WATER POLLUTION
48625, 48680, 48692, 48699, 48700, 48882, 48943, 49013, 49127, 49350, 49426, 49433

WEATHER MODIFICATION
48685, 49133, 49139, 49159, 49377, 49404

WEST VIRGINIA
49386

WET CYCLONES
48843

WETTING
48764

WIND ROSE
48948

WIND TUNNELS
48973, 49017, 49336

WINDS
48646, 48948, 49118, 49135, 49141, 49148, 49150, 49152, 49153, 49154, 49160, 49163, 49165, 49166, 49167, 49168, 49169, 49174, 49180, 49186, 49187, 49192, 49193, 49194, 49195, 49200, 49204, 49206, 49207, 49211, 49259, 49406

WOOD (MATERIAL)
49250

WOOLS
49371

X

XYLENES
48831, 49218

Y

YOKKAICHI
49232, 49257, 49284, 49314

YOKOHAMA
49292, 49342

Z

ZINC
48827

ZINC COMPOUNDS
48639, 48951, 49034, 49112, 49115, 49241,
49263, 49325, 49327, 49330, 49331, 49345

AUTHOR INDEX

A

ABE K 49292
ABE S 49228
ADAIR P F *48702
ADDIS D H 49338
AGRAWAL K B 48938
AKABAYASHI T 49166
AKASHI T 48870
AKHTAR S *48703
AKLAND G G 49261
ALLEN G D 48853
ALPEROVICH M A *48704
ALTYNBAYEVA R D 49329
ALYEA F 49132
AMANO M 49041
AMAYA K *48958, *48959
AMBLER T C *48705
AMERY E *48706
ANDERSON R D *48960
ANDERSON R F 48910
ANDO A *49096
ANDO J *48623, 48654, *48707
ANDREN A W 48680
ANDRUSENKO Y N 48961
ANGLE C R 49320
ANIKEYEV V A *48961
ANNEN Y 48873
ANTONYUK O K *48624
AOKI M 48818, 48819
AOKI S 48669
AOYAMA T 48984
ARMSTRONG J G *49193
ASAHARA H 48956
ASAI K *49097
ASAKAWA T *49398
ASHIMOV A A 48718
ASMADSHIJEWA K *49258
ATKINS R S *48708
ATLAS R 48692
ATROSHCHENKO A V *48709
ATTFIELD M D 48964
AUM F *49371
AUMGARDNER R E *48962
AZELBORN N A 48960
AZUMA K *48710, 48738

B

BACCI P *49137
BAKER G L *48963
BAKHINA T S 49325
BALDWIN R C 49250
BARNARD R E *48711
BARNEBEY H L *48712
BARRETT L B *49366
BARTON V J 48994
BASU K 49079
BATTIGELLI M C *49326
BAVINCHOVE OSSOLA Y V 49131
BAZZAZ F A 49336
BEAVINGTON F *49331
BECK R R 48808
BECKETT S T *48964
BECKWITH W F *48713
BEILKE S 49134
BENSON F B 49215
BENTLEY H T 49235
BERGERT K H *48965
BERN J *48625
BERNSTEIN A B *49194
BERNSTEIN D 49110
BERRY B J L *49399
BERRY R F 48928
BETHEA R M *48626
BETTELHEIM J *48694
BETZ E C *48714
BETZ V 48965
BHANTI D P 48919, 49080
BIAGLOW J A *48618
BIANCO A *49316
BICKELHAUPT R E *49216
BILLINGS C E *48715
BIRKY M M 49250
BISCHOFF W F 48755
BISCHOFF W F JR *48695
BLACK F M *48947
BLANCK H 48841
BLASZAK T P 48634
BLOCK C *48619
BLURTON K F 49047, 49048
BOBROWSKY C A *48716
BOECKER B B 49317
BOKI K 49233
BOLTON N E 48642, *48680
BRACHACZEK W W 48658
BRAUN G F 48784
BRENNAN E 49335
BRIEHL D *49098
BRIGGS D E 48779
BROWN J 49210
BRUBAKER J H 48963
BRUZEWICZ A S 49399
BUCHALD R M *48717
BUCKLE E R *49217
BUENING H J 48720
BUGAYEV V P 48961
BUHR R K 49088
BUMGARNER J E 49243
BUROVOI I A *48718
BUTLER L R P 49034
BYKHOVSKIY A V *49323

C

CAIN W S *48966
CALDWELL W M JR 48822
CALLAWAY B 49432
CALVERT S *48719
CAMUFFO D *48948
CARANCI M A *49400
CARGO D B 49399
CARLSON R W 49336
CARNUTH W 49170
CARTER J A 48642, 48680
CASSADY M E *48967
CATO G A *48720
CAVALLERO L T *48721
CAVANAGH L A *49128
CEDARHOLM O S *48722
CERNANSKY N P 48665
CHALISHAZAR B H *48909
CHAMBERLAIN C E *48968
CHANEY L W *49090
CHANG R K 49078
CHASSAING P *49211
CHAUSSY L M 48816
CHENG C H *48969
CHIA C J *48943
CHIBA H 49299
CHOI P 48700
CHOW W 48942
CHRISTMAN R D *48723, *48724, *48725
CHU R R *49218
CHUPINA T V 49420
CICERONE R J 48667, *49138
CIRILLO R R 49129
CLARIA A 49211
CLARK T A 48962
CLOSSON A 49202
COCHRAN N P *48726
COHEN A S *49360
COLE E N *48727
COLE H M 49326
COLLINS A C 48694
COLVERT J H 48728
CONSER R E *48910
COOK K D 48642
COONS W R JR *48728
COOPER H B H JR 48843
COOPER P *49242
COPPINS B J 49351
CORTE G L *49076
COTE W A *49099
COULSON C L *49332
COYNE P 49210
CRABLE J V 49091
CRAIG G D 48794
CRAWFORD T L 49199
CREASON J P *49243
CRENTZ W *48681
CREWS W B *49259
CRIDER W L 49215
CROSS F L JR *49100
CROW G E *48729
CRUTZEN P *49139
CUDDIHY R G *49317
CUMMINGS J B 49399
CUNNOLD D *49132
CUSHING K M 49087

D

DAHMANN D C 49399
DAMS R 48619
DANA M T 49239
DASCHER A J 48977
DAUTOV F F 48752
DAVIES C N *48627
DAVIES J H *49077
DAVIS A *48730
DAWIDKOWA K 49258
DAY A G 48904
DE GAETANI C F 49330

DE LA FUENTE M G *48731
DE SOUZA T L C *48949
DEE N 48700
DEEPAK A *48970
DELANY A C *49140
DELWICHE C C 48692
DENNIS R *48732
DENNIS R L 49135
DESAI H B *48911
DEUEL C L *49219
DEURBROUCK A W *48733
DEVIVO C C 48720
DICK D L 49337
DIEHL E K *48734
DILLON T J *48735
DINGER B G 49250
DINGO T T *48736
DISMUKES E *48737
DITTRICH W *48620
DOHSHITA H 48870
DOI K 48710, *48738
DOI M 48649
DORFMAN Y Y *48739
DORN F 49327
DORSEY J A *48971
DOSS J H *48740
DOWNING P B *49401
DOWNING R H 49367
DRAEMEL D C *48741
DREW C M 49022
DREW J W *48696
DRUMMOND D 49344
DUA S K 48919, 49080
DUBINSKAYA F Y 48799
DUBOIS L 49016, 49076, *49092
DUCE R A *49195
DUGDALE R 48632
DUNBAR R B *48690
DYSON P 48628

E

EARL C B *48742
EBERT J *49260
EDDY D S *48972
EDWARDS H W *48973
EGAN B A *48682
EGUCHI T 49265
EGUCHI Y 49015
EINHORN I N 49250
EISAWA E 48661
EISENBUD M 49110
ELDER H W 48836
ELEK I 48650
ELFIMOVA Y V 49297
ELISEI G 49137
ELLIOTT G E JR 48723, 48725
ELLISON W *48743
ELNAGGAR H A 48860
ELNICKI W J 48721
EMERY J F 48642, 48680
ENDO Y 48771, 49026
ENGDAHL R B 48847, *48912
ENGELS L H *48744
ENGEN T *49434
ENSOR D S *48974
EPSTEIN A 48682
ERGANG R *49357
ESSENHIGH R H 48904

F

FAINGOLD N I 48739
FAIRBANKS D 48692
FAIVRE PIERRET R 49202
FARKAS W R *49244
FASCHING J L 49195
FEL DMAN N G *49324
FELICE M S 48994
FERGUSSON G J 48904
FINE D H 48660
FINKLEA J F *49261
FIRMAN J E *48697
FIRST M W *48745
FISH B R *49237
FLEMMING G *49141
FOUCHE D G *49078
FRAIZE W E *48628
FRANKLIN W E 48672
FRASER D A 49326
FRECH K J *48746
FREEDMAN R W 48968
FREISER H 48953
FRIEDRICHS K H *48950
FUJIE K *49101
FUJII T 48750, 48996, *49220
FUJIMA Y 48871
FUJIMURA M *48951, 48982
FUJISHIRO Z *49262
FUJITA M 49001
FUJITANI F *49142
FUJITANI Y *49102, *49103, *49143, *49144
FUJIWARA *49402
FUKAMI N 48761
FUKAYA H 48647
FUKUCHI T *48975
FUKUDA M *48976, 49280
FUKUNAGA K *48747, 48838
FUKUSHIMA H 49000, 49044
FUKUSHIMA S 49014
FUKUSHIMA Y 49278
FUKUYAMA J *48748
FUKUYOSHI M 49220
FUKUZAWA H *48749
FULKERSON W 48642, 48680
FUNABASHI S 49178
FUNASHIMA M 48990
FURUKAWA S 48651
FURUKAWA Y 48990
FURUTA S 48750
FURUTANI C 48651
FUSAMURA N *48750
FUSE J 48623, 48654
FUTRELL J W 49432

G

GAMBLE H B *49367
GAMOU M 49191
GANDHI B K 48932
GANGULY A K 49085
GARCEA G *48751
GARTRELL F E 49199
GARVIN D *49221
GAVRILYUK M V 48906
GEBICA M *48698
GENCO J M 48847, 48912
GHAZI A *49145
GIBB F R 49316
GIBERTI R A 48967
GIMADEYEV M M *48752
GIVEN P H 48730
GLEASON R J *48939
GLEKOVA L N 48827
GLUZMAN S S 48739
GOEL P K 48929
GOHEEN P G 49399
GOI K 49160
GOODNIGHT H E 48907
GOODRICH J C 49431
GOPALAKRISHNAN K V 48936
GORCZYCA M *49403
GORDON C C *49354
GORDON D 48692
GORDON T *49263
GOSWAMY P *49079
GOTO H *48629
GOUSE S W JR 48628
GOVAN J H 48745
GOYAL M C 48909
GRAMS G W *48977
GRANTHAM L F *48753
GREBINICHENKO N G 48827
GREEN A E S 49087, *49146, 49164, *49264
GREEN G P *48754
GREEVES G 48918
GRENS E A II 49207
GRIFFITH W C 49317
GRINBERG K M 49061
GRINBERG L *48630
GROBECKER A J *49404
GROSS G P *48683
GRUNNET M L 49250
GUCK R *49377
GUELPH G T *48631
GUENTHER T *49327
GUSEV M I 49297

H

HAASHI F *48632
HABIB Y *48755
HAKE R D 49173
HALL C A S *49133
HAMAMOTO O 48999
HAMANAKA H *49378
HAMERSMA J W *48756
HAMILTON P A 49181
HAMPSON R F 49221
HANAI S 49052
HANASHIMA M *48633
HANIOKA N *49265
HANSFORD R C *48757
HANSLER G M *49405
HANSON G P *49338
HARDESTY D R *49238
HARDIN D 49432
HARING H G *49222
HARRIS D B 48971
HARRISON R M *48978
HARTKAMP H *48979
HARWOOD C F *48634
HASEGAWA K 49178
HASEGAWA T 48666, *48980, *48981, 48998, 49030
HASEGAWA Y 48656, 49009
HASHIMOTO J 48648
HASHIMOTO M 48989, *49223, *49379
HASHIMOTO S 48780
HASHIMOTO T 48875
HASHIMOTO Y 48951, *48982
HASHIZUME K 49108
HASLETT R A *48758
HATANAKA K *48983
HATIA S P 48949
HATTORI H *48759
HAUSBERG G *48760
HAWKSWORTH D L *49351
HAWTHORN R D *48940
HAYAKAWA M *48984
HAYAMA T *48635
HAYASHI K 49185, *49266
HAYASHI T 49153
HAYASHI Y 49054
HAYASHIDA S *48761
HAYES J V 49136
HAYFORD J S 48862

HAZEN W 48692
HEACOCK F 48939
HEANEY R J 48808
HEAP M P 48797
HEATH R L 49332
HECHT R W 49129
HEDEN S D 48743
HEDLEY W H *49224
HEGEDUS L L *48762
HEGEMANN K R 48760
HEGGESTAD H E *48636
HEIKEN G *48985
HEINES T S *49147
HEITLAND H *48763
HEMSATH K H *48945
HENDERSON G S 49182
HERLAN A *49095
hERTZENDORF M S *48986
HESHMAT CHAABAN G *48987
HESKETH H E *48764
HEWITT P J *49318
HIDAKA S 49292
HIGASHIDA T *49267
HIGGINS F B JR 48858
HIGH L E 48947
HIGUCHI K 48863
HIMI Y *48637, 48657, 49045
HINNERS T A 49243
HINO M *49148
HINTON M G 48941, *49429
HIRAI K *49104
HIRAMATSU M *48765
HIRANO K 49026
HIRAOKA T 49185
HIRASAWA S *48988
HIRATSUKA T 49345
HIROBE H 49108
HIROO J 49166, 49179, 49230
HIROSAWA I 49116
HIROSE H *49214
HIROTA Y 49350
HIROYASU H *49225
HIRSCH W Z *49368
HIRST E *48699
HISHIDA K *48638
HISHIYAMA Y 49342
HITCHCOCK D 48692
HIWATARI S *48766
HOCHDAHL O *48621
HODGESON J A 48962
HOELSKEN H *48639
HOFFMAN G L 49195
HOFMANN D J 49171
HOFMANN W *48640
HOGSTROM U *49149, *49196
HOLLAND J F 48955
HOLLEMAN N G 48928
HOLLIFIELD C 49432
HOLMAN H F *48767
HOLT E L *48768
HOLTZMAN R B *49319
HONDA A 48748
HONDA H *49339
HONJO H 48772
HONMA K *48989, *48990, *48991, *48992, 49121
HORNUNG R W 49091
HOSHIKA Y *48641, *48993, 49062
HOSONO Y 48648, 48649
HOSOYA E 48772
HOWARD J B 48660
HRUBESH L W *48994
HUBA F *48769
HUCKABEE J W *49333
HUDSON J E 48904
HUGHES J M 48843
HULETT L D *48642
HULL A P *48684
HUNT R G 48672
HURTER A P JR 49360

I

ICHINOSE M *48952
IGARASHI T 49097
IIDA Y 48644, 48771
IKARI K *49406
IKEDA A *49150
IKEDA K 48638, 49104, *49105
IKEDA M *48770
IKEDA Y 48815
ILCEWICZ F H 49319
IMAGAMI K *48995, 49036
IMAMURA K *48996, 49220
IMAZEKI S 49160
INABA F *48997
INGALLS M N *48643
INGOLD *49356
INOUE E *49440
INOUE H 48791
INOUE K *48644, *48771
INOUE R *49106, *49107
INOUE T *48772
INUI T *48773
IONESCU V *48774
ISHIDO S *49358
ISHIGURO T 48666, 48980, *48998, 49000, 49014, 49030, 49044
ISHIHARA K *48775, 49026
ISHIHARA Y 48749
ISHII A *48645
ISHII T 48780
ISHIKAWA K *48999
ISHIKAWA T 48791
ISHINISHI N 49278
ISHINISHI S *49268
ISHIZUKA K 49035
ISRAEL G W *49151
ITAI K 49286, *49340
ITO E 48984
ITO K *49269
ITO M 49152
ITO N 48983
ITO S 48831, *49152
ITO Y 49102
ITOH H 48748
IURA T 48941, 49429
IVANOVA G M 49158
IWASA M 49278
IWASAKI Y *49000, 49014, 49044
IWASE S *49270
IWASHIMA K *49001
IYER N V 48929
IZAWA Y 49011
IZMEROV N F *48913
IZOTOVA A I *49002
IZUMI Y *48646, 49154

J

JACOBSEN P S 48733
JANZEN S A 49333
JARRAULT P *49407
JENKINS D M 48912
JHA G S 48922
JOANNES G *48776
JOHNSON C J 48920
JOHNSON E B *48777
JOHNSON J M 48896
JOHNSON J T *49432
JOHNSON O B *48914
JOHNSTON W H 48904
JONES D G 48896
JONES J S P *49271
JONSSON E *49272
JOSHI P P 49080
JUNGMANN H 49260
JUTZE G A *48778

K

KADOTA T 49225
KADOWAKI R *49003
KADOWAKI S 48641, 49062
KAGAWA J *49245
KAGOTANI S 48980
KAIZU Y *49108
KAJIWARA Y 49001
KAKUTA M *49153
KALAIMANNAN S *48915
KALEN B *48916
KAMENSHCHIKOV I G 48800
KAMINARI T *49004
KAMIURA T 49037, 49038
KAMIYA A 49053
KAMIYAMA S *49273
KANAJI T 48657
KANEGAMI H *49274
KANENO M 48878
KANNAN V *48917
KANO N 48999, *49005
KANO Y 49109
KANOH F 48819
KANTER H J 49170
KANZAKI K 48873
KAPLAN C P 49399
KAPOOR R K *49209
KAPP K W *49361, *49408, *49435, *49436, *49437
KARAPUTINA G I 48709
KARASAWA S 49026
KARYAGINA Z V 49197
KATASE T 49249
KATO T 48629, *48647, *49006, *49109
KATSUYAMA T 49111
KATZ D L *48779
KAWADA T 49112
KAWAGISHI S 49124
KAWAGUCHI H *49007
KAWAI K 48669, *49275
KAWAI S 49214
KAWAI Y *49008
KAWAKAMI M 49108
KAWAMORI M 49304
KAWAMURA H 49112
KAWASAKI G *48648, *48649
KAWASAKI H *48780
KAWASHIMA E *49154
KAY A I *49276
KEAIRNS D L 48828
KEEFE M 48682
KELLY J 49432
KENDRICK W P 48756
KERTESZ SARINGER M *49155
KERTZ W *48781
KESZTHELYI K *48650
KHAN I M *48918
KHEMANI L T 49209
KIFUNE I 49039
KIHN H E *48782
KII T 48905
KIMOTO M 49108
KIMURA K *49277
KIMURA N *49009
KINSMAN S *49010
KIRSCH J W *49156
KISAICHI K 49122
KISHI Y 49105

KISHIKAWA Y 49041
KITA H 49293
KITABAYASHI K 48989, 49223
KITAGAWA Y *48651
KITAMURA H 48980, 48998
KITAMURA S *49011
KITAMURA T 49037
KITAZUME M 49026
KIUCHI M 48864
KIZIM I A *48783
KLEIN D H 48642
KLEINMAN M 49110
KLOOSTER H J *48784
KLOSE J 49310
KNEEBONE B M *48953
KNEIP T J *49110
KNEISEL C 49432
KOAYASHI N 48826
KOBAYASHI H *48785
KOBAYASHI N *49012
KOBAYASHI S 48905
KOBAYASHI T 48997
KOBAYASHI Y 49160
KOBUKU K *48786
KOBYLINSKI T P *48787
KODAMA H 49012, 49268
KODAMA T *49013
KODAMA Y *49278
KOIKE K 48641, 48993, 49003, 49062
KOIKE S *49111
KOIZUMI A 48638, *49246
KOJIMA I 48641, 48993, 49003, 49062
KOMINEK E G 48743
KOMURO I *49157
KONDO A *48788, *48789
KONISHI J *48790
KONNO M 48880
KONNO S 49040
KONOSU H *49094
KOOPMAN D B 49399
KOSHI S 48992
KOTRAPPA P *48919, *49080
KOVAL SKIY V V *49329
KOYAMA H 49228
KOYAMA I *49014
KOYAMA T 48637
KOZAI Y 49054
KOZE H *48791
KRAFT M L 48756
KRAMER L 49319
KRASNOVSKIY A A 49241
KRAUSE F R *49081
KREKELER H 49328
KUBOTA K 48644
KUBOTA T 49103
KUMATA W 49154
KUNIN A M 48739
KUNITAKE E 49278
KURKIN V P *48792, *48793
KURODA D 48981
KUSUMOTO S 49289
KUSUNOSE K *49112
KUWATA K *49015

L

LADY E R 48779
LAGUE J 48682
LAHAYE P G *48794
LALOR W G JR *49362
LAMANTIA C R *48795
LAMB R F 49399
LAMP F W 48904
LAND G W *48796
LANDERS W S 48754
LANE D C 48949
LANGER A M 49248
LANGLEY J C JR 49367
LAO R C *49016
LAPEDES D E *48941
LAPPLE C E *49017
LARSEN D J 49091
LARSEN R I 49261
LAVERY T 48682
LE VAGUERESE P *48797
LEAS L E *48920
LEAS R L 48920
LEAVITT J M 49199
LEBEDYUK G K *48798, *48799, *48800
LEE J A 48858
LENANE D L *48801, *48802
LENNERT A E 49235
LENTO L L JR 48898
LESTER L 49432
LETUPOVA S V 49329
LEVIN I W *49018
LEVITOV V I *48803
LEWIS C K 48808
LEWIS T R *49279
LIMANSKIY V A 48961
LINDVALL T *49019
LINZON S N 49344
LIVKE T N 48906
LIVSHITS G S *49197
LOBO W E 48779
LOISE J A 48716
LONGHETTO A 49137
LORENZ G *49020
LOVELOCK J E *49113
LOWDER J E L 49086
LOWES T M 48797
LUCAS R L *48946
LUSCHE K 48622
LUZSA I *48804
LVOV Y A *49158
LYON W S 48642, 48680
LYSHKOW N A *49226

M

MACCRACKEN M C *49159
MACKID J C 48690
MACLEAN D C *49341
MAEDA H 49302
MAEDA I 48770
MAEKAWA S *49247
MAELZIG G *48622
MAES M *48652
MAGET H J R *48805
MAHAPATRA A K *49198
MAHONEY J R *48685, 49431
MAIRA S K *49082
MAKINO K 49119, 49280
MALIKOV V V 48800
MALKI K W 48832
MALKIN I 48769
MAMURO T 49021, *49114
MANEVAL D R 48814
MANTHAPURWAR N S 49082
MANTLE E C *48806
MANZ O E *48921
MARGERUM L F 49399
MARSH E N *49215
MARTIN J R *48807
MARTIN W C 48896
MARUYA H 49265
MARUYAMA M 49116
MASEK V *48954
MASHIKO Y 49094
MASON B F 49156
MASUDA K 49031
MASUDA T 49185
MATHESON K H JR *48808
MATHUR H B *48922
MATSUDA Y *49021, 49114
MATSUI K *48809
MATSUI T 49108
MATSUMOTO H *48653
MATSUMOTO T 48997
MATSUNAMI T 49114
MATSUNARI F 49142, 49144
MATSUO K 48888, 48981
MATSUO Y 49015, 49052
MATSUURA A 48623, *48654
MAUBON A *48810
MAZZOCCO N J 48703
MCCOWN B *49210
MCELROY M B 49189
MCEWAN W S *49022
MCINTIRE M S *49320
MCKINNEY J D 48723, 48724, 48725, *48811
MCLEAN J D *48955
MCLLVEEN W D 49344
MCPETERS R D 49087
MEHTA P *48923
MEHTA S M 49224
MELCHER J R *48812
MELNGAILIS I *49023
MELTZER J 48941, 49429
MENYUK N 49027
MESZAROS E 49155
MEYERS R A 48756
MEYERS S *49380
MICHELS D E *49024
MIDDLETON R F 48914
MIKESELL M W 49399
MIKHAYLOV A V 49420
MILLER A *49248
MILLER T L *48813
MILLER W E 48711
MINAGAWA K 49039
MINAKAMI E 49350
MINASE K *49025
MINNICK L J *48814
MINOR B M 48807
MITO Y 48818
MIWA M *48815
MIYAMOTO A 49283
MIYAMOTO F 49178
MIYAMOTO I 48648, 48649
MIYAMOTO T 49053
MIYAMURA N 48983, 49108
MIYASHITA T *48816
MIYAZAKI K 48905
MIYAZAKI S 48637, 49045, 49229
MIYAZAKI T 48976, 49358
MIZOGUCHI I *49115, 49117, 49119, *49280
MIZOGUCHI Y 49220
MIZOHATA A 49021, 49114
MIZUHATAKE T 48770
MIZUMA M 49167, 49168
MIZUTA H 49009, *49026
MIZUTANI H 49053
MIZUTANI N 49185
MO T 49264
MOBLEY H E *49409
MOGI S *49160
MOGI Y 49178
MOHR U 49295, 49296
MOLINA M J *49161, *49162
MOMO E 49253, 49254
MOMOSE S 49032
MONKMAN J L 49076, 49092
MONROE E S *48817
MONTGOMERY T L *49199
MOOKHERJEE A *48924
MOORADIAN A 49023, *49027, *49028
MOORE C S *48925
MOORMAN W J 49279

MORAN J B 49261
MORGAN D J 49399
MORGAN L 48630
MORI K *48818
MORI M 48788, 48789
MORIGUCHI M 49176
MORIMOTO S 49040
MORISHITA S 48791
MORITA M 49117
MORITA Y 48873, 49265
MORIYAMA N 48649
MORLIN Z 49155
MOROZOV V P 48718
MOROZUMI K *48819
MORROW P E 49316
MORTON B G 48720
MOSCOWITZ C M 49224
MOSKOWITZ H R 48966
MOSS W A *48820
MOTOYAMA K *48821
MOY D *48822
MOYERS J L 49195
MROSE H *49163
MROWKA J P 49399
MUELLER K *49363
MUKHOPADHYAY A *48693
MURAKAMI K 49105
MURAKAMI M *48823
MURAKAMI Y 49011
MURAMATSU F 48637
MURANUSHI A 48876
MURASE H 49112
MURATA M 48983, 49108
MURRAY M F *48824
MURRMANN R P 49210
MURTHY B S 48936
MURTHY N S *48926
MUSTAFA M G *49281
MUTSUURA T *49342
MUYSERS K 49328
MYAGKOV B I 48800
MYERS R L *49083

N

NACK M L *49164
NAGAI H 48980, 48998, 49004
NAGAMORI M 48632
NAGAOKA S *49282
NAGASE M *49029
NAGATA K 48638
NAGATA Y 48666, *49030
NAGAYAMA K 49265
NAGOYA T 48750
NAGUMO S I 48825
NAITO N 49220
NAKADOI T 48981, 49038
NAKAGAWA T *49283
NAKAJIMA C 49150
NAKAJIMA H 49041
NAKAJIMA M 48854
NAKAJIMA T 48646, 49154, 49289
NAKAJIMA Y 48646, *48825
NAKAKOI T 49037
NAKAMURA K *49165
NAKAMURA R *49284
NAKAMURA T 48879
NAKANE Y 49358
NAKANO K *49031, 49292
NAKANO M 49185, *49285
NAKAO S 48623, 48654, *49032
NAKATA M *48826
NAKATANI S *49227
NAKAYA M 48780
NAKAYA S *49286
NAKAYAMA N *49287, *49288
NAKAYAMA S 49006
NAKAZAWA Y *49116
NASU Y 49096
NATUSCH D F S *48655
NELRICH Y M *48827
NELSON G V 48728
NELSON W C 49261
NEWBY R A *48828
NEWIRTH R 48858
NICHOLS G B *48829
NICOTRA C 49202
NIEDING G VON *49328
NIEPENBERG H P *48830
NIEPOTH G W 48727
NIHEI H 48638
NIKAIDO T 49111
NISHIKAWA K *48831
NISHIMURA M 49011
NISHIMURA S 48669
NISHINO S *49033
NISHIWAKI M *48927
NITZ G 48979
NIZHNIK S S 49442
NOBE H 49160
NOER J A *48832
NOGAMI H *49289
NOGI T 49220
NOHIRA H *48833
NORVAL E *49034
NOSE K 49290
NOSE Y *49290
NOUSHI H *49321
NOUTANI K 49278
NUKADA Y *49291
NUMAKAWA M *49035
NYSSEN G A 48642

O

O DELL L J *48834
ODA H 49289
ODANI S 49299
OGATA M *48956
OGAWA M 49012
OGDEN E C 49136
OGIKUBO T *49228
OHI G 49302
OHIRA T 49000
OHMORI K *49292
OHTA T *49117
OISHI M 48975
OISHI S *49036
OKA M 48976, *49037, *49038
OKADA G 48785
OKAJIMA T 49009
OKAMOTO S *49166, 49179, 49230
OKAMOTO Y 49300, 49301
OKAMURA M *48835
OKANO H 49160
OKITA T *49039, *49040
OKUMURA T *49041
OKUNO T *49042
OLLINDEN G A *48836
OMICHI S *49293
OMOROV T B 49197
ONISHI S *48837
ONO K *49043
ONO T *48656
ONOZUKA H 49000, *49044
OOTA H 49152
OOTSU K 49299
OOTSUKA Y *49045, *49229
OPALANKO R S 48967
OPPENHEIM A K 48665
ORCUTT J C 48862
ORR C JR 49218
OSAKI T 48747, *48838
OSAWA S 49280
OSHIMA R J *49352
OSHINO A *49167, *49168
OSHIRO K 48819
OSKINA V N *49046
OSWIN H G *49047, *49048
OTA H 49029, 49186, *49249
OTA Y *49343, 49358
OTAKI A 49166, 49179, *49230
OTSUKA Y 48637
OTTAR B *49200
OVCHARENKO N V *49294
OVERCASH M R 48659
OXLEY J H 48847, 48912
OYA F *48657, *49169
OYA S 48750
OZAKI K 49300, 49301
OZARSKI R 48970

P

PACKHAM S C 49250
PADVA V Y 48961
PAHLICH E *49334
PARASKOS J A 48811
PARKS D J *48686
PASHEK R D 49367
PATIL M S 49085
PAYRISSAT M *49134
PEARSON R G *49344
PELL E J *49335
PELLEU G B JR *48928
PENNER S S 49086
PERILHON P 49202
PERROUD P *49201, *49202
PERRY R 48978
PERVIER J W 48858
PETAJAN J H *49250
PETERS B C 48969
PETERS L K 49147
PETERS W *48839
PETRAS E F 48856
PETRICK D *49093
PETROV V F 49420
PEVNYY N I 48827
PHILLIPS N 49132
PICARD H *49131
PICCININNI J P 49399
PIERSON W R *48658
PILAT M J 48974, *49049
PINE A S 49027
PINKERTON C 49243
PINNICK R G 49171
PISTORIUS D 49263
PLEYBER G 49201, 49202
PLUMLEY A L 48807
POHLENZ J B *48840
POINTON K C 49217
POLLOCK W H 49140
PORTER H F 48946
POWERS J E 48779
PRAMER D 48692
PRATAPAS J 49129
PRINCE M *48841
PRINN R 49132
PROVE W 49131
PRUZINEC J *49084
PUNDIR B P *48929

Q

QUARLES J *49369, *49370, *49381, *49382,
*49383, *49384, *49385, *49386, *49387,

*49388, *49389, *49390, *49391, *49392, *49393, *49394, *49395, *49396, *49410, *49411, *49412, *49413
QUINBY A H 48745

R

R K BAKSHI 48922
RABEN I A 48795, *48842
RAGLAND K W *49135
RAKHMANOV B N 49323
RAM KUMAR G 49082
RAMAN M C *48930
RAMAN V 49082
RAMANA MURTY B V 49209
RAMCHANDAR C K *49374
RAMU M C S *49322
RASIN TEK M 48779
RAVAN J E *49414
RAWLANI P B 49085
RAWLINGS G D *48843
RAYNOR G S *49136
REED R D 48907
REGAN J W *48844
REIFENSTEIN E 48682
REIQUAM H *48700
REITER E R *49203
REITER R *49170
RESHIDOV I K 48704, 48783, 48803
RESNICK L 48687
REZNIK SCHUELLER H *49295, *49296
RIGO H G *48845
RIJCKEGHEM W V 49131
RIPPERTON L A 48659
RITCHIE J E JR 49215
ROBERTS R M 49219
ROBINSON J M 48720
ROCKEL M 49357
RODGERS L W *48846
ROESS D *49050
ROGERS H *48659
ROGERS J E L *48660
ROLAND F S 49162
ROSE F 49351, *49353
ROSEN J M *49171
ROSENBERG H S *48847, 48912
ROTE D M *49129
ROWLAND F S 49161
ROWLAND S *49172
ROZHKOVSHIY D A 49197
RUSSELL P B *49173
RYCHLIK F J *48848
RYZHKOVSKY V L *49297

S

SACHAR K S 48812
SADAKANE Y 48651
SAEKI 48999
SAEKI T 48956
SAIJO T *48661
SAITA T *48849, *48850
SAITO J *48662
SAITO K 48661
SAITO M 48664
SAITO T 49152
SAKABE T 48647
SAKAGAMI J *49174, *49175
SAKAI T 48984
SAKAMORI S 48648
SAKAMOTO A 49111
SAKATA H *48851
SAKATA M 48998
SAKATA S 49111
SAKIHARA K 49052
SAKURAI S 49286, 49340
SALEEM A *48852
SAMATA M *48663
SANANES F 49211
SANDORFY C *49231
SANTOS A R *48853
SANTOS O R 48853
SARATHY A P 48936
SAROFIM A F 48660
SASAKI K *48854
SASTRY P L K 49085
SATO I 49167, 49168
SATO J *49176
SATO M 49185
SATO S 49035, *49118
SATO T 48791, 48815
SATO Y 48849, 49115, *49119, 49280
SAUERLENDER O H 49367
SAVCHENKO M F *49298
SAVIANO M S 49330
SAWADA T *48855, 49146
SAWANOORI T *48664
SAWATARI I *49299
SAWYER R F *48665
SCHILLING W 48745
SCHOENBECK H *49355
SCHOENHERR R *48942
SCHOTTE W *48931
SCHOWALTER K A *48856
SCHRAMEL P 49310
SCHULTE K A *49091
SCHURTZ G D 48967
SCHWAB L *48857
SCHWARTZ W A *48858
SCHWARTZWALDER K *49364
SCHWARZMANN M *48701
SCOTT D S *48859
SEBAYASHI T *49300, *49301
SEHMEL G A *49239
SEKI H *49302
SEKI K 49169
SEKI M 48980, 48998
SEKI Y 48905
SELIKOFF I J 49248
SELLAKUMAR A *49303
SELMECZI J G *48860
SEMRAU K *48861
SENDA T *49304
SERIZAWA S 49313
SHAH K T *48932
SHAPOSHNIKOVA E Y 49002
SHAVER R G *48933
SHAW D R 48690
SHEDLOVSKY J P 49140
SHEEHAN J D *48862
SHETTLE E P 49146
SHEVCHENKO P F 49002
SHIBATA T 48831, 48875
SHIBUYA O 49299
SHIGETA Y *48666, *48863, 48980, 48998, 49030
SHIKATA H *49177
SHIMASAKI K 48818
SHIMIZU T 49288
SHIMOI Y *48864
SHINOZAKI M *49345
SHINTANI K 49042
SHIOBARA M 48854, 48878, 48880
SHIOBARA S 49299
SHIOYA M *49178
SHIOZAWA K 49166, *49179, 49230
SHIRAKAMI K 49265
SHIRASAWA T *49441
SHIRVAIKAR V V *49204
SHITAZU F *48865
SHODA K 48837
SHODA T 48646
SHOJI H *49232
SHUBIK P 49303
SHUVALOV V A *49241
SHY C M 49261
SIGAL I Y *49442
SIGSBY J E 48947
SIMECEK J *49051
SINGH V D *48934
SISSONS N V *49120
SITARAMAN V *49085
SKUJINS J 48692
SLADEK I *49180
SLADKOVIC R 49170
SLAMINSKI J M *48691
SLATER D H 48978
SMIDT U 49328
SMITH F *48692
SMITH J H 49128
SMITH M L 49349
SMITH W M *48866
SNYDER A D 49224
SNYDERMAN J S 48904
SODA T 48651
SOGA K 48818
SOISSON J A 49399
SOLOMON L H *48935
SONENBLUM S 49368
SOWLS R E 49235
SPACKMAN W 48730
SPENCER H 49319
SPRINGER K *49438
SPRINGER K J 48643
SRINIVASA RAO P *48936
ST DENNIS J 49368
STAIB E G *48867
STARA J F 49279
STEBBINGS J H JR *49305
STEINEKE F *48868
STEINER P 48695
STEPANOV E N 49002
STEPHENS J B *49181
STERN A C *49415
STEVENS R K 48962
STEWART D J *49306
STEWART D W 49364
STOKINGER H E *49251
STOLARSKI R S *48667, 49138
STRAITZ J F III *48869
STRAUCH D *48668
STUHL F *49240
STUIVER M 48692
STUKEL J J 49336
SUDA T *48870
SUESS M J *49430
SUGA S 49153
SUGA K *48669
SUGA N 49143
SUGAI R 49039
SUGIMAE A *49052
SUGIYAMA K 48662
SULZMANN K G P *49086
SUNAGA T *48670
SUNDARARAJAN A R 48919
SUNDARARAMAN N *49205
SUNDARESAN B B 48917
SUSEY P E 48945
SUTTER S L 49239
SUZUKI F *48671
SUZUKI H 48831
SUZUKI M 49026, 49144, *49365
SUZUKI S 49037
SUZUKI T *49252
SUZUKI Y 49011, 49124, 49286
SVENSSON H *48937
SWANK W T *49182
SWENSON D O 48832
SYLVESTRE BARON M 49201, 49202

T

TACHIBANA K 48638
TACHIKAWA K 48927
TAGUCHI K 48661
TAJIMA T 49063, 49148
TAKADA T 48750
TAKAHASHI T *49121
TAKAHASHI Y 48766, *48871, *48872
TAKAHATA H 49001
TAKAI Y 49013
TAKATSUKA M 48983
TAKAYASU M *48873
TAKEDA Y 488[illegible]
TAKEFUJI T 48788, 48789
TAKEMOTO K *49307
TAKEUCHI J *49053
TAKEUCHI K *49183, *49184
TAKEUCHI N 48666, 49030
TAKEUCHI S 49112
TAKISHIMA T *49308
TAKIZAWA J *49346
TAKIZAWA Y 49039
TAMAOKI A *48874
TAMURA H 49108
TANADA S *49233
TANAKA K *48875
TANAKA M 49038, *49253, *49254
TANAKA T 48775
TANAKA Y 48647, 48648, 48649, 48835
TANIGAWA T *49054, *49185
TANIMOTO M *48957
TANINAKA T 48990
TANIYAMA T *49347
TAO Y 49186
TARANCON G 48841
TATRAI F 48650
TATSUTANI B *48876
TAYLOR B 49432
TAYLOR B W 48787
TAYLOR O C *49348
TAZUMA J J 48746
TEICHMAN T 49016, 49092
TEIRSTEIN A S 49248
TERAI K 49096
TERANISHI K *49309
TERASAWA K 49026
THIEME R *49310
THOMAIDES L *48877
THOMAS J A *49311
THOMAS J W *49234
THOMAS R S 49016, 49076
THOMSON J A L 48970
THORNE L 49338
TIMINI G P *49330
TKACHENKO V M 48783, 48803
TOCHIO Y 48888
TODA G *48878
TODA T *48879
TODA Y *48880
TOKUDA M 49104
TOLGYESSY J 49084
TOMITA K 48833
TORII T *48881
TOYAMA T 49245
TOYAMA Y 48775
TOYOGUCHI T *49122, *49123
TOZAWA T 49292
TRAIN R E *49416, *49417, *49418
TRICHE C 48987
TROLINGER J D *49235
TROUT A M 48618
TROUT D A *49206
TRUFFER M 49259
TSEYTLIN A N 48709
TSUBOTA Y 49289
TSUGAWA S *48882
TSUJI M 49042
TSUJI S *48883, *48884
TSUKAMOTAO N *49312
TSUKAMOTO S *49313
TSUKAMOTO T 49300, 49301
TSUKATANI T 49167, 49168, 49232
TSUNAKAWA M *49419
TSUNEOKA M *49186
TSUNETOSHI Y 49287, 49288
TSUNODA F 49286, 49340
TSUNODA T 49227
TUERK E F *49372
TURECEK J L 48794
TWARK R D 49367

U

UCHIYAMA M *49187
UCHIYAMA Y *48885
UDAGAWA M 48771
UEDA G 49185
UEDA J 49265
UEDA K *49255
UEDA M *48886, 49287, 49288
UEHARA H 48957
UENO S 48651
UMEDA K 49041
UMEKI M 49150
UNO H 48990
URBAN P *48887
USHIMARU Y *48888
USUI H *49359
USUI K 48780
UTHE E E 49017
UTSUNOMIYA K 48818

V

VALDBERG A Y 48799
VAMOS E 48650
VAN BROCKLIN L V 48862
VAN DIEPENBROEK A E W *48889
VAN HEUSDEN S *49055
VAN HOOK R I 48680
VAN LOAN M *48687
VARGYAI J *48890
VASILEV N V 49158
VASILOFF G N *49349
VAYSMAN Y I *49420
VAYSSIERE P *48891
VERMEULEN T 49207
VESTAL M L 48904
VIDT E J 48828
VIEZEE W 49173
VILAND C K *48892
VIRUPAKSHIAH R *48938
VOGT G A 48784
VOLDAEVA I I 48906
VOORHEES K J 49250

W

WADA O *49256
WADDELL T E 49366
WADE W A III 49099
WADE W R 48960
WAGNER M 49328
WAIDL E 49310
WAKAMATSU S *49188
WAKIYAMA K 49406
WALDRUP D 49432
WALKER H M *48688
WALLACE E C 49353
WALLER G *48893
WALTERS S 49138
WANG C H T 48918
WANG I T 49129
WANGEN L E 49129
WARD G *49087
WARDA R D *49088
WARSHAW A 48735
WASAMOTO M 48761
WASSELL A B *48894
WATANABE T 48771
WATANABE Y *48895, 49106, 49107
WATANAE T 49347
WATSON W D JR 49401
WEBER H 48902
WEDDING J B *49336
WEINBERG F J 49238
WEINTRAUB M 48703
WEIR A JR *48896
WELCH R O *48672
WELCH W R *49337
WERCZERGER E *49421
WESSELY I *49056
WEURMAN C *49057
WHITE H J *48897
WHITMAN R H *48898
WIELAND W *49213
WILDER J E 48715, 48732
WILEY R F *48899
WILKIE W H 49237
WILLIAMS B 48779
WILLIAMS G C 48660
WILLIAMS J K *48900
WILLIAMS L 49432
WILLIS B 48682
WILLIS B H *49431
WILSON G R 48723, 48724, 48725
WINGES K D *49207
WINKLEY J H *48901
WITHAM C L 48861
WOFSY S C *49189
WOHLGEMUTH R *49422
WOLF G L 49320
WOOLLEY J A 48942
WRIGHT C V *49397
WRUBLESKI E M 49400
WU M S *49208
WUNDERLICH G *48902
WYMAN C M 48977

Y

YAGI K 49041
YAGI S *48903
YAGYU H 49119, 49280, 49302
YAMADA T 48809
YAMADA Y 49265
YAMAGATA N 49001
YAMAGIWA H *49314
YAMAKI N *49058
YAMAMOTO H 48871
YAMAMOTO K 48876, 49299
YAMAMOTO M 48905
YAMAMOTO S *49190, 49191
YAMAMOTO T *49350
YAMANAKA C 49011
YAMANAKA S 49214
YAMAOKA S 48976
YAMASAKI Y 49015
YAMASHITA E 48990
YAMASHITA H 49186
YAMAUCHI S 48710
YAMAZAKI M 48648, 48649
YANAGI S 49112
YANG Y Y 49279
YATABE T *49059, *49060

YAUKI K *49124
YAVOROVSKAYA S F *49061
YAVORSKY P M 48703
YERGEY A L *48904
YOCUM J E 49099
YOKOTA F 48647
YOKOTA M 48826
YOKOYAMA A 49143
YOKOYAMA O 49190, *49191
YOKOYAMA T 49103, 49142
YOKOYAMA Y 49225
YONEBAYASHI Y 49299
YONEKAWA E 49289
YONEYAMA E 49026, 49292
YONEZAWA S 49054
YOSHIDA H 49154
YOSHIDA J 49169
YOSHIDA K *49257
YOSHIDA R 49266
YOSHIDA Y *48905
YOSHIDOME A 48710
YOSHIMOTO K 48641, 48993, *49062
YOSHIMOTO S 49005
YOSHIMURA T 48825
YOSHINAGA Y 49026
YOSHINO M *49063
YOSHINO N 48835
YOSHITANI K 48657
YOSHIZAKI K 48772
YOSHIZUMI K 48644, 48771
YU H H S 49224
YUI S 48837
YUZAWA S 49160

Z

ZAIKA P K 48906
ZANDERS D L 49224
ZARAYEV O M 49323
ZAYTSEVA N V 49420
ZDROJEWSKI A 49092
ZENZ F A 48916
ZHUKOV N A *49325
ZHUKOV V I *48906
ZINK J S *48907
ZLATKIS A *49064

ORDER FORM

USE RESTRICTED AS INDICATED IN THE INTRODUCTION

SEND TO:

ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION TECHNICAL INFORMATION CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

Date ______________________

Name ______________________

Program ______________________

Address ______________________

THIS FORM IS TO BE USED FOR ORDERING MICROFICHE DUPLICATES. INDICATE THE ARTICLES YOU REQUIRE BY CIRCLING THEIR APTIC NUMBERS. IF YOU DO NOT HAVE ACCESS TO A MICROFICHE READER, YOU MAY REQUEST PAPER COPIES. HOWEVER, MICROFICHE CAN USUALLY BE PROVIDED IN ABOUT 1/5 THE TIME REQUIRED TO PROVIDE PAPER COPIES.

68897 68942 69036 70195 70224 70298 70299 70300 70301 70303 70305 70306 70307
70308 70309 70310 70311 70312 70317 70321 70322 70332 70333 70337 70338 70340 70341
70342 70343 70344 70345 70346 70349 70354 70357 70361 70362 70365 70373 70376 70377
70378 70380 70381 70383 70388 70392 70393 70394 70395 70396 70397 70398 70399 70400
70401 70402 70403 70404 70405 70407 70408 70409 70410 70411 70412 70413 70414 70417
70418 70419 70420 70421 70422 70423 70425 70426 70427 70428 70429 70430 70432 70433
70435 70436 70437 70438 70439 70440 70441 70442 70443 70444 70445 70446 70447 70448
70450 70451 70452 70455 70456 70457 70458 70459 70460 70461 70462 70464 70465 70466
70467 70468 70469 70470 70471 70472 70473 70474 70475 70476 70477 70478 70479 70480
70481 70482 70483 70484 70485 70487 70488 70489 70493 70494 70500 70511 70512 70516
70520 70542 70546 70548 70557 70559 70561 70563 70572 70573 70575 70580 70588 70591
70594 70600 70606 70613 70620 70626 70627 70635 70636 70642 70643 70648 70649 70662
70674 70675 70676 70683 70693 70697 70701 70702 70720 70733 70734 70735 70746 70747
70748 70751 70752 70753 70754 70756 70759 70776 70784 70785 70786 70787 70788 70789
70793 70795 70796 70798 70803 70804 70805 70806 70807 70808 70809 70810 70811 70812
70813 70814 70815 70816 70817 70818 70819 70822 70823 70824 70825 70826 70827 70829
70830 70831 70832 70833 70834 70836 70837 70838 70839 70840 70841 70842 70845 70846
70847 70850 70852 70853 70856 70857 70858 70859 70860 70861 70862 70863 70864 70865
70866 70867 70868 70869 70871 70872 70873 70874 70875 70876 70877 70878 70879 70880
70881 70889 70891 70892 70893 70894 70896 70897 70898 70899 70900 70901 70902 70903
70904 70905 70906 70907 70908 70909 70910 70911 70912 70913 70914 70915 70916 70917
70918 70920 70922 70923 70924 70927 70928 70929 70935 70937 70939 70940 70941 70942
70943 70944 70945 70946 70947 70948 70949 70951 70952 70953 70954 70955 70956 70957
70959 70960 70961 70962 70963 70964 70965 70966 70967 70968 70969 70970 70972 70973

70974 70976 70977 70978 70979 70980 70981 70982 70983 70984 70985 70986 70987 70988
70989 70990 70991 70992 70993 70994 70997 70998 70999 71000 71001 71002 71003 71004
71005 71006 71007 71008 71009 71010 71011 71012 71013 71014 71015 71017 71018 71019
71020 71021 71022 71024 71025 71026 71027 71028 71029 71030 71031 71032 71033 71034
71036 71037 71038 71039 71040 71041 71042 71043 71044 71045 71046 71058 71059 71060
71061 71062 71063 71064 71065 71066 71067 71068 71069 71070 71071 71072 71073 71074
71075 71076 71077 71078 71079 71080 71081 71082 71083 71084 71085 71086 71087 71088
71089 71090 71091 71092 71093 71094 71095 71096 71097 71098 71099 71100 71101 71102
71103 71104 71105 71106 71107 71108 71109 71110 71111 71112 71113 71114 71115 71116
71117 71119 71120 71121 71122 71123 71124 71125 71126 71127 71128 71129 71130 71131
71132 71133 71134 71135 71136 71137 71138 71139 71140 71141 71142 71143 71144 71145
71146 71147 71148 71149 71150 71151 71153 71154 71155 71156 71157 71158 71159 71162
71163 71164 71166 71167 71168 71169 71170 71171 71172 71173 71175 71176 71177 71178
71179 71180 71181 71182 71183 71184 71185 71186 71189 71190 71191 71192 71193 71195
71196 71199 71200 71201 71202 71203 71204 71205 71206 71207 71208 71209 71210 71211
71212 71213 71214 71215 71217 71218 71219 71220 71221 71222 71223 71224 71225 71226
71228 712[illegible] 71230 71231 71232 71233 71234 71235 71236 71237 71238 71239 71240 71241
71242 71243 71244 71245 71246 71247 71248 71249 71250 71251 71252 71253 71254 71255
71256 71257 71258 71259 71260 71261 71262 71264 71267 71268 71269 71270 71271 71272
71273 71274 71276 71277 71278 71279 71280 71281 71282 71283 71284 71285 71286 71287
71288 71289 71290 71291 71292 71293 71294 71296 71297 71298 71300 71301 71302 71303
71304 71305 71306 71307 71308 71309 71310 71311 71312 71313 71314 71315 71316 71317
71318 71319 71320 71321 71322 71323 71324 71325 71326 71327 71328 71329 71330 71331
71332 71333 71334 71335 71336 71337 71338 71339 71340 71341 71342 71343 71344 71345
71346 71347 71348 71349 71350 71351 71353 71354 71355 71356 71357 71359 71360 71361
71362 71363 71364 71365 71366 71367 71368 71369 71370 71371 71372 71373 71374 71375
71376 71377 71378 71379 71380 71381 71382 71383 71384 71385 71386 71387 71388 71389
71390 71391 71392 71393 71394 71395 71396 71397 71399 71400 71401 71402 71403 71404
71405 71406 71407 71408 71409 71410 71411 71412 71413 71414 71415 71416 71417 71418
71419 71420 71421 71422 71423 71424 71425 71426 71428 71429 71430 71431 71432 71433
71434 71435 71436 71438 71439 71440 71441 71442 71443 71444 71445 71446 71447 71448
71449 71450 71451 71452 71453 71454 71455 71456 71457 71458 71459 71460 71461 71462
71463 71464 71465 71466 71467 71468 71469 71470 71471 71472 71473 71474 71475 71476
71477 71478 71479 71480 71481 71482 71483 71484 71485 71486 71487 71488 71489 71490
71491 71492 71493 71494 71495 71496 71497 71498 71499 71500 71501 71502 71503 71504
71505